

THE Chemical Age

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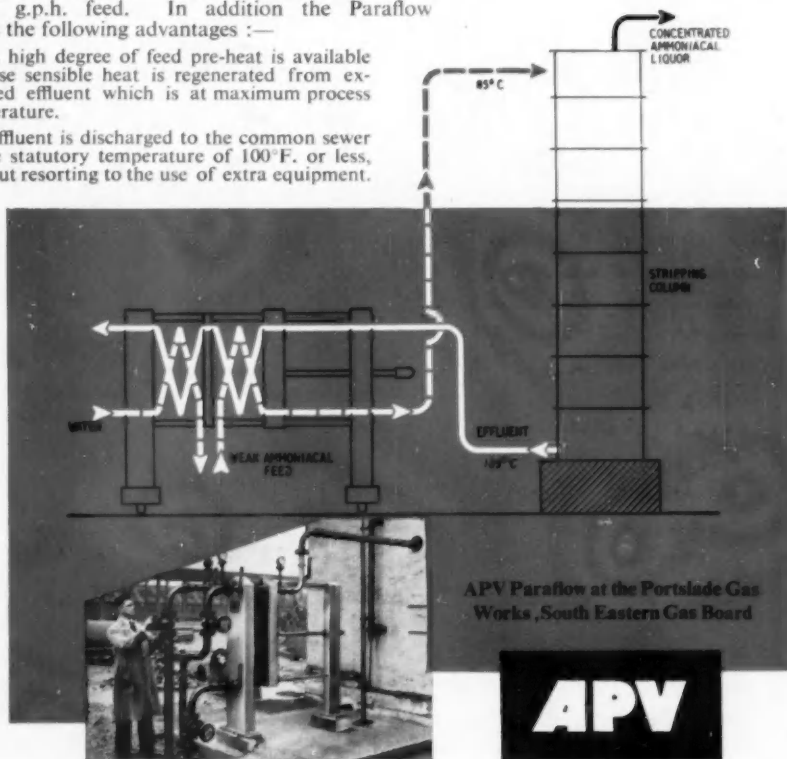
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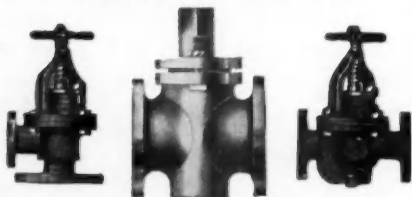
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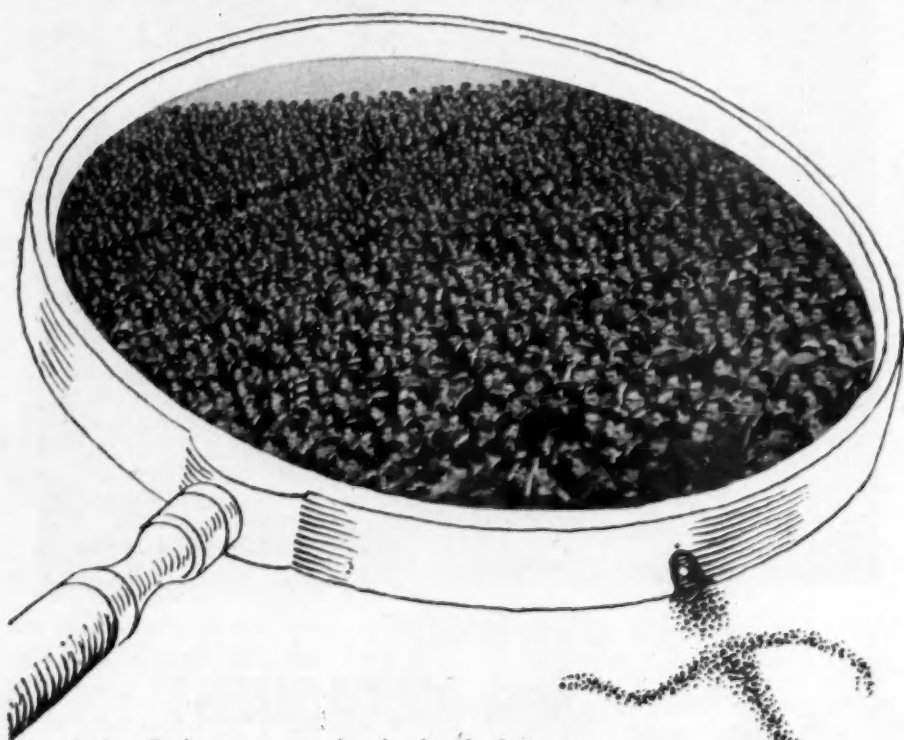


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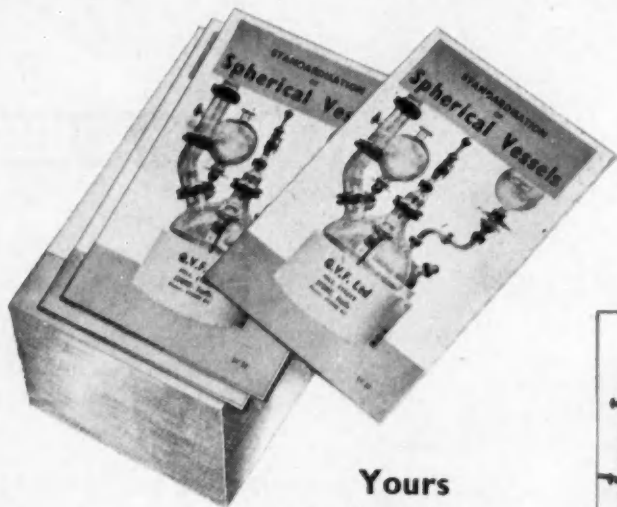
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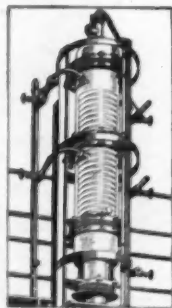
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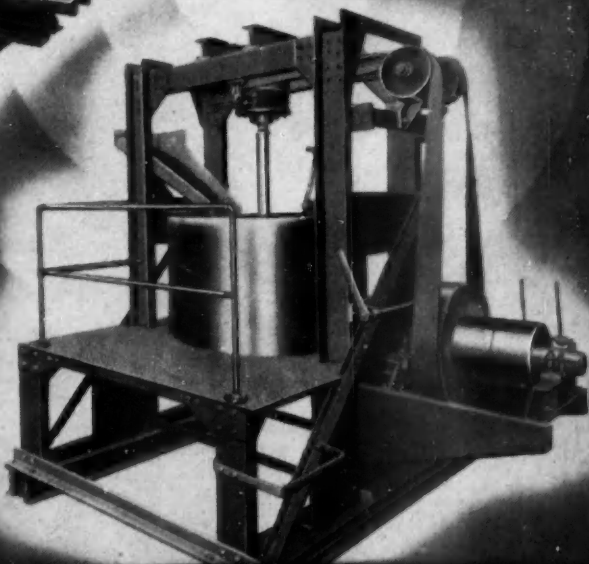
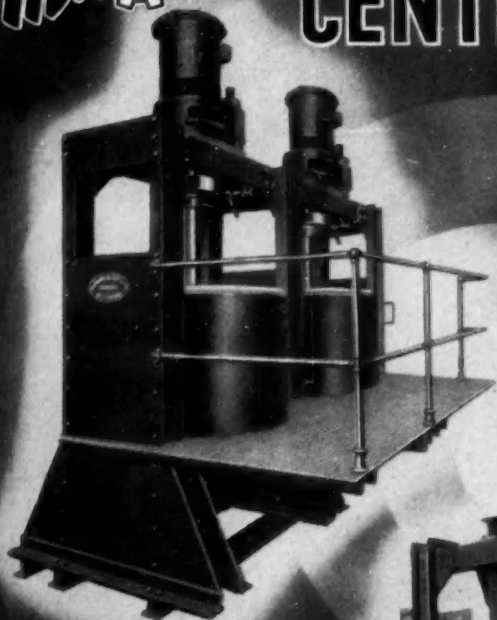
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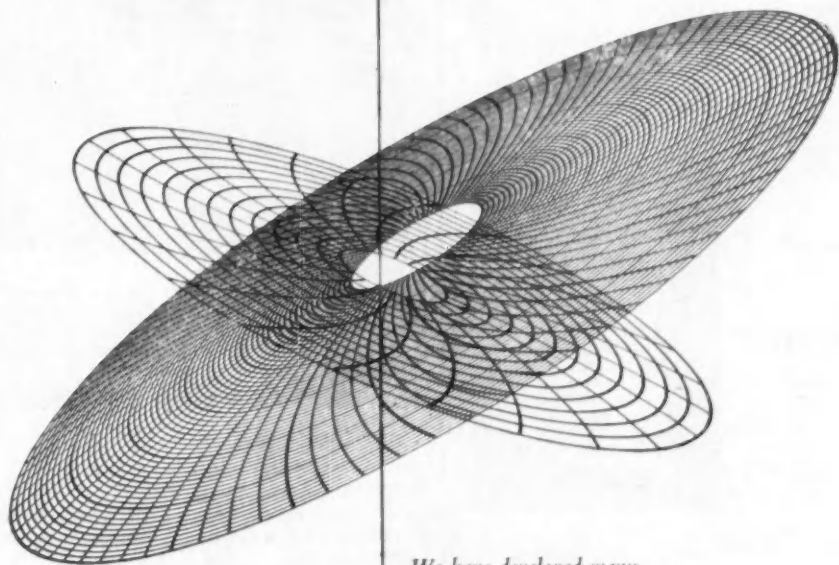
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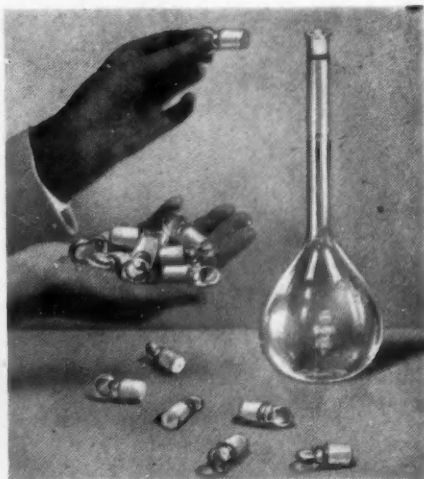
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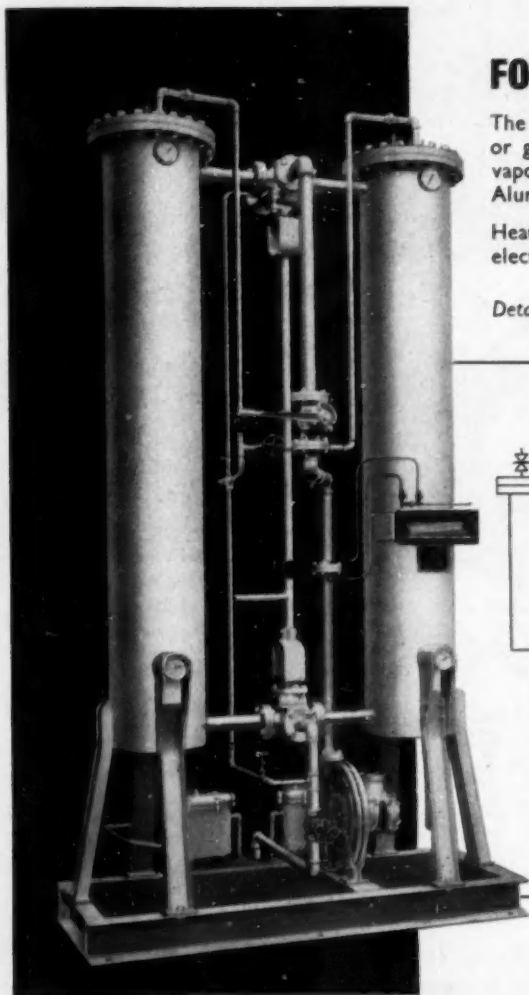
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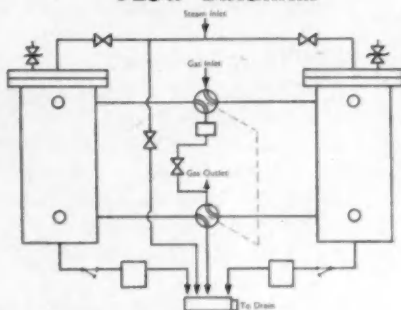
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Work Study

WORK study has been so naturally applicable to the assembly production lines of engineering industries that its rôle in other industries tends to be sluggishly appreciated. It is no doubt true to say that more factories have hitherto kept work study outside their doors than those which have let work study in. Already these two generalisations beg for a definition. A precise one is that work study is the systematic and detailed study of work in order to raise productivity by the more effective use of material resources or human effort. A less precise definition will be preferred by some—that work study is an attitude or discipline of mind, and so far as an industrial organisation is concerned, the extent to which that attitude of mind is held—from boardroom to workers' messroom—mainly determines the contribution that work study can make.

The biggest problem in work study development is to get it started. Resistances and reluctances must be overcome, and they are inevitably found at all levels. Successful introductions of work study methods may *seem* in retrospect to have evolved steadily—but the italicised word is the key word. Work study as a basis of change in a factory is revolutionary, not evolutionary. It brings challenge to long-established outlooks and procedures. Revolution without discord and damage is a difficult achievement.

Two new booklets published by the Association of British Chemical Manufacturers—both of them 'Notes on Work Study', the first sub-titled 'How

to Start', the second, 'Some Results'—can hardly be overpraised. They are the result of the ABCM's action in setting up early last year a Work Study Advisory Committee, which in turn resulted from the 1952 visit of a British Productivity Team to study America's heavy chemicals industry and the 1953 Work Study Conference held by the ABCM at Buxton. Presumably it is the intention of the ABCM's Work Study Committee to publish a steady series of these 'Notes'.

In the sense that the idea of work study must still be 'sold' to so many firms who can derive rich harvests from it, the second booklet might well be read before the first. In this, executives from 14 firms that have introduced work study review the results, in most cases merely the initial results, from first applications. The B.B. Chemical Co. Ltd., who employ 650 people, started a work study department—first in single charge of an Oxford graduate, now already joined by a second man—only 20 months ago. Large economies have been achieved through the study of raw materials handling, finished products handling, through package and container standardisation, and by plant layout study. One important department whose output had proved inadequate to meet demand was scheduled for building expansion and additional plant installation; a detailed study showed that increasing the size of the building alone, without extra plant, could raise output by one-third. The Eaglescliffe Chemical Co. Ltd., stimulated by the report of the Productivity Team and the Buxton Con-

ference, started a work study section by having two existent members of staff specially trained. A saving of £100 to £200 a year by rearranging the method of handling empty bags; a 20 per cent rise in output by revising the method of operating a small plant; a saving of about £4,000 a year through completely reorganising the packing and handling procedures on a larger plant; these benefits have so far been derived 'by the application of method study, without the introduction of stop watches or detailed work measurement'. Hardman and Holden Ltd., with three works altogether employing some 900 persons, started a work study department in 1950, also by having two of the existent staff specially trained. So far plants employing 70 per cent of the labour force have been studied, with considerable benefits that have involved little or no capital expenditure. As examples of these benefits, the labour cost of one product has been reduced by 50 per cent; output on one plant raised by 40 per cent with only a 12 per cent increase in labour force; on another plant, output raised by 25 per cent with a 27 per cent reduction in labour force; in one process 17 handling operations in the product-finishing stage have been reduced to one, with the elimination of two machines and a 30 per cent saving in labour; and a planned expansion in another plant which had been bottlenecking a production line was shown to be unnecessary by revising the method of plant operation.

The three examples we have selected will perhaps encourage members of the chemical industry to obtain this invaluable ABCM booklet and derive considerably more encouragement from all fourteen 'case-studies'. That work study works and pays handsome dividends is certainly left in no doubt, and the reactionary attitude that it is just another excuse for extra executive officers or another questionable manifestation of theoretical planning must fade away in the face of such positive and diverse evidence. The slightly smaller booklet, 'How to Start', then becomes invaluable. Work study is a skilled industrial function. If it is to be successful, it is no 'amateur' sideline task for executives

whose time is already fully occupied.

Above all else, the 'right man for the job' must be selected and he must have the 'right' status. The necessary qualities listed are 'enthusiasm, steady persistence, leadership by respect, technical training, and an enquiring mind allied with common sense'. As for status, he should be directly responsible to a high-level executive, but from the outset it should be clear that his function is advisory, providing 'a service to management'. Firms, especially smaller firms, might well introduce work study methods by using the services of a consultant; alternatively, a member of a firm's staff can be chosen and sent for training at one of a number of specialised centres. The booklet specifies a list of registered work study consultant organisations and provides as appendix a list of 23 training centres whose courses are suitable for the chemical industry's requirements. The consultant approach has an advantage for the smaller firm in that the consultant, with his wider knowledge, may be far better qualified to find the most suitable young member of the staff for training to become the subsequent full-time work study officer. The firm with 100 or so employees should find that one such officer, if he has clerical help, is sufficient.

But 'the right attitude of mind must be encouraged at all stages', and the booklet stresses the need for higher executives to devote ample time to supporting work study developments and for work study appreciation courses for most levels of management and administration. The work study officer is an advisor and a reasonably receptive reaction to his efforts is clearly essential. Nor can work study results be obtained without the willing co-operation of workers and their trade unions. The booklet far from evades this somewhat delicate matter. The indispensability of clear and advance consultation is emphasised.

These two booklets, admirably written and presented, can be the forerunners of a most substantial rise in the chemical industry's productivity. The ABCM has given a lead—how many firms will follow it?

Notes & Comments

Fuel Flash

IN a week of stormy weather no flash of lightning was more sudden and vivid than the announcement of sharp rises in the price of coal. The thunder is still rumbling. None of the wounds of inflation seem to sting as much as jumps in the price of coal. For the domestic consumer the rise does not merely bring a minimum addition of £2 or £3 to the total annual bill for solid fuel but it must also bring 10 or 20 per cent additions to gas and electricity bills—in all and at the lowest possible assessment, a far stiffer advance in the cost of living than most tax-savings from the last budget can balance. For industry the effect must vary widely according to the importance of coal, gas, electricity, etc., as a manufacturing material. No industry can escape but some will be less acutely affected. The fact that stock exchange prices seem so far to have absorbed the shock buoyantly is dangerously misleading. Non-fixed interest shares have been steadily rising in price for many months, and much of this general trend is a defensive action against inflation, a recognition that money itself steadily buys less and less while shares in industry at least maintain their value. In one sense the rise in the price of coal damages industry's prospects; but in another—as a severe twist in the spiral of inflation—the rise adds to the value of shares. It is the counter-action of these two opinions that has eased the market impact of the National Coal Board's grim announcement.

The Other Side

YET in the long run the nation's economy need not be so threatened. So much of our former prosperity has been based upon cheap coal in abundance that our outlook towards coal and coal-based fuels tends to be nostalgic and old-fashioned. We are not merely a coal-minded nation, we are a coal-wasting nation. Many of those who have campaigned for fuel economy in recent years

have felt that the driving force that brings economy—the sheer force of £. s. d.—is insufficiently operative. Dearer coal should mean more resolute plans to reduce tonnage, especially in those industries where fuel costs are not a dominant component in the total make-up of costs. A universal drive to save coal could comfortably offset all the effect of the new rises in fuel prices. As our fundamental coal problem is a supply problem—to produce enough from our own mines to meet all demands—the long-term benefits of coal-saving progress could substantially outweigh any immediate and adverse effects of higher prices upon our general manufacturing economy. A furnace modification that reduces an annual consumption of 100 tons to 90 tons will continue to save 10 tons a year for many years; the dearer coal is, the more likely it is that established methods of fuel economy will be financed and installed. There at any rate is the brighter side, and it need not be belittled.

Sodium Metabisulphite

A SUBSTANTIAL new market for sodium metabisulphite seems likely to be developed within the next few years. As a preservative, this sulphur-dioxide-releasing chemical is not, of course, a novelty; both in the 1914-18 and 1939-45 wars it was much used in tablet form for preserving bottled fruit, though in peacetime when more sugar is available the pasteurisation process is usually preferred. The preservation of green crops, notably of grass, for use as winter food for cattle is one of the largest-scaled operations of farming. Somewhat slowly in this century, but nevertheless steadily, the ensiling method has advanced. It is, even when moderately well done, a more efficient method than making hay; if less efficient than machine-drying, it is easier and cheaper. Generally, however, the product is variable. Silage-making conditions require a good deal of control if adverse fermentation changes are to be minimised. Thus

molasses are often added to the silage pit to serve as food for the acid-forming bacteria for if enough acid is produced odorous fermentations are inhibited.

Removing the Uncertainty

IN fairly recent years American research in Pennsylvania has shown that the addition of powdered metabisulphite takes most of the uncertainty out of silage-making. The fresh green crop can be used without a preliminary wilting period to reduce its moisture content. The undesirable butyric group of break-down products are not formed, only the far more useful lactic group. The sulphur dioxide steadily released in the silage pit or clamp keeps the forage in a state that is much closer to its fresh form than any other silage technique. Dry matter losses are said to be reduced by 25 per cent and carbohydrate losses by as much as 50 per cent.

Potential Demand Large

THE introduction of this newish method into British farming can be regarded as one of the certainties of the future. A number of tests are being closely watched by the Ministry of Agriculture this year. At present, and despite the outstanding success of the method in America, the Ministry is not prepared to recommend it without reservation. But silage has made inadequate progress here because present methods yield a variable product, one that is often unpleasant and difficult to handle. Sodium metabisulphite can produce a much more popular product. About 8 pounds per ton of fresh green crop is required. In a few years' time the tonnage demand for sodium metabisulphite may make it a major agricultural chemical. Over 5,000,000 acres of grassland in England and Wales are cut for hay, silage, or drying every year; if 5 per cent of this total 'cut' was metabisulphite-treated, the amount required would be at least 25,000 tons. The 'potential' is much bigger for a reliably successful silage method would stimulate more silage-making at the expense of hay-making.

Leather Chemists' Conference

PROVISIONAL programme of the International Union of Leather Chemists' Societies Conference to be held in Stockholm at the Kungl Tekniska Hogskolan (Royal Technical Institute) from 1 to 4 August is:—

Monday, 1 August. Morning: Meeting of delegates, official opening ceremony and presidential address. Afternoon: Lectures by Drs. Baumann, Kanagy and Mitton on 'The Properties of Leather.' Discussion, and meeting of commissions.

Tuesday, 2 August. Morning: Lectures by Drs. Penkhurst, Balanyi, White, Kuntzel, Otto and Turley on 'Fundamentals of the Chemistry of Tanning Processes.' Afternoon: Continuation of the symposium and discussions on the lectures. Evening: Reception at Stadshuset, the Town Hall, by invitation of the Stockholm City Council.

Wednesday, 3 August. Morning: Reading and discussion of scientific papers. Lecture by Professor W. Grassmann on 'Our Present Knowledge of Collagen.' Afternoon: Visit to Skansen, the National Folk Park, followed by a visit to an old tannery. Evening: Swedish Leather Industry & Allied Industries' excursion around the archipelago of Stockholm.

Thursday, 4 August. Morning: Reading and discussion of scientific papers. Afternoon: Scientific papers, general meeting and open meeting to receive reports from commissions. Close of Conference. Evening: Barquet in town hall.

On the Sunday before the Conference there will be a meeting of the executive committee of the International Union, and the registration and reception of delegates and visitors at the Tekniska Museet (The Technical Museum). Thos. Cook & Sons have been appointed official travel agents.

Stabilised Sulphuric Anhydride

Industrie Chimiche Dr. Baslini of Milan announce that they have recently completed a plant for the manufacture of stabilised liquid sulphuric anhydride using a new process developed and patented by the company. The stabilising agents are said to be entirely new and quite different from those used by other processes, e.g. that of Allied Chemical & Dye Corporation of New York which markets this sulphonating agent under the trade name 'Sulfan'.

Thermoplastic Resins

A Review of Some Moulding Techniques

SINCE 1938 vinyl organosols and plasticols have found useful applications in the manufacture of industrial and domestic articles. Upholstery materials suitable for motor cars and household furniture have been obtained by the impregnation of textile materials with plasticised polyvinyl compositions. Their chemical inertness and stability to polar and non-polar solvents are a few of their many useful characteristics. Pipes made of these plastic materials have therefore been used in chemical processes. In other fields also, plastic vinyl masses have found important applications; thus they feature in the production of packing rings, porous packing materials and in the coating of wires and cables for insulation purposes (1). These applications have involved the use of polyvinyl chloride-alkyl acrylate copolymers; high boiling plasticisers such as tricresyl phosphate being used as the solvent medium.

Plasticols may be suitably produced from spray dried copolymer by mixing with plasticiser. Often there is an initial increase in viscosity on mixing resin with plasticiser, which may be reduced for example by homogenising (1). A conventional plasticol may be prepared by mixing equal parts of PVC (spray dried powder) and tricresyl phosphate in an open vessel, a viscous mass being obtained after standing some hours. Slow rotating turbo-mixers ensure the exclusion of air.

Dipping Operations

Solutions of polyvinyl resins in suitable solvents (organosols) are able to function in dipping operations, suitable formers for example being dipped in the organosol and then removed as in conventional dipping processes (7). Hollow articles have been prepared making use of lubricated mandrels, the latter dipping into plasticised masses (2).

These dipping operations are of interest because using organosols, the technique appears more facile than the operations involving rubber latex. The difference is essentially due to the specialised gelation technique necessary in the latter, which often incurs an additional stage in the manufacture.

The curing stage in rubber latex processes also requires the inclusion of special curing ingredients. In dipping operations using organosols, no special chemical treatment is necessary, the criteria for successful moulding or dipping being the viscosity of the plastic medium, and the temperature of the former before dipping. Fusion of the organosol is accomplished in either hot air or infra-red ovens. This latter stage is quick and may be completed in five to ten minutes.

Pneumatic Methods

Contrasting this with dipping operations using rubber latex, we note that the latter process may require the initial dipping of the former in a gelling mixture, comprising electrolytes such as calcium chloride and sensitisers such as complex zinc ammonium salts. The former so coated with coagulant is then dipped into the rubber dispersion, sufficient time being allowed for adequate coating of the former with rubber. Curing completes the process (3).

Hollow articles in plastics materials have been manufactured by pneumatic methods. This simply involves inflation of the plastic masses by compressed air, the plastic preform thereby assuming the shape of the mould. The preforms are generally prepared by extrusion technique. In this way articles made from polyvinyl resins, polyamines, polyurethanes, polyesters and polythene have been successfully manufactured. Other modifications introduce steam into the mould and preform, the latter thereby being ultimately shaped to the contours of the mould.

Polythene has been used in the manufacture of bottles, the process involving extrusion and blow moulding, the plastic mass being extruded into split moulds and inflated to the desired shape by compressed air. The latter is introduced through a channel in a double conical shaped extrusion nozzle (4).

Perhaps the most economical of all the processes used is that described as the 'Slush' process. It is a method that, being simple in nature, lends itself to speed and adaptability. This process has been adapted for the manufacture of such hollow-ware as hot water bottles, boots, plastics tubes for tooth-

pastes and creams, etc. Essentially employing viscous masses, it is used where the accuracy of mould contours are not of undue importance. The 'Slush' moulding technique as the name implies involves the use of fluid masses in open moulds. In such processes the polymer should not have a solubility in plasticiser greater than five per cent at 20° C, based on weight of plasticiser, while the vapour pressure of the plasticisers used should be around 1.3×10^{-5} mm. at the same temperature (1).

Cheap & Quick Method

The 'Slush' moulding technique is not impeded by these refinements which are associated with injection and compression moulding operations, and is therefore a cheap and quick method for the moulding of hollow articles. 'Slush' moulding has of course been effected using plastic masses of natural rubber. When porous moulds are employed in the process, such moulds for example being made of porcelain or plaster of Paris, gelling is spontaneous due to the absorption of water and hydrophilic stabilisers; the use of impervious moulds on the other hand, necessitates initial dipping of the mould in suitable gelling compositions, followed by the introduction of rubber latex.

In carrying out the 'Slush' moulding technique using vinyl plasticols, water free plasticisers are introduced into the mould, sufficiently to allow gentle agitation of the fluid mass, thereby facilitating simple de-aeration. Decantation of the liquid contents of the mould ensues; a supernatant ungelled liquid leaving a gelled plastic substrate on the walls of the heated mould. The mould may then be refilled with plasticol containing blowing agent if desired, thereby obtaining a cellular layer in the resulting hollow article.

Curing is effected by heating the plastic substrate in a second oven, the resulting pieces being removed from the mould by means of compressed air. The gelling temperature is of importance because it determines the thickness of the piece being moulded. This is made to occur in a first oven. The temperature of the gel will also have an influence on the curing effect in the second oven.

The criteria for successful moulding involves the use of pure plasticisers, that impart the correct viscosity for the required operation, the aim of which is to produce

certain desired characteristics. High viscosity plasticols are needed to produce articles having good feel and flexibility (5). Their other disadvantages, viz: the tendency to discolouration at the higher temperatures may be obviated by the inclusion of vinyl heat stabilisers, as lead carbonate and silicate.

In blowing operations high viscosities are undesirable, because a plasticol may render blowing operations less facile. Viscosities may however be modified by the application of a wetting agent. The quality of the cellular product is probably influenced by the choice of blowing agent and the viscosity index of the plasticol. The quantity of gaseous material and the temperature at which it is liberated are again factors influencing the quality of the cellular product.

On simple considerations *pp'*-oxy-bisbenzene sulphonyl hydrazide would afford gaseous volumes based on the release of one molecule of hydrazine, while on the other hand, butane *bis* 1:4-sulphonyl hydrazide would yield twice this amount; other things being equal, therefore, such facts, from the stoichiometrical comparisons made, connote a greater production of gas pressures from the aliphatic blowing agent, than would be expected from the aromatic agent. The former compound would show therefore greater tolerances for positive changes in viscosity. In the production of light coloured articles, the blowing agent should not discolour.

Choice of Plasticiser

The viscosity of the plasticol is clearly related not only to the amount of plasticiser and resin utilised, but also to the choice of constituents used. Thus the choice of plasticiser is of importance in the conversion of plastigel to cured product; polar plasticisers such as the aryl phosphates tending to have higher fusion points. Other factors of importance in successful moulding is the heat transference of the metal mould.

Fusion temperatures vary from 325° F to 400° F (e.g. Greenspun, *loc. cit.*). The time of curing at the lower temperature is approximately 20 minutes, which is reduced to five minutes at the higher temperature. Feebly polar aliphatic plasticisers tend to have lower fusion temperatures than the more polar aromatic types, and in consequence the former afford products that have reduced heat and tear resistances in com-

parison with products produced from the latter.

Cellular pieces have been obtained by 'Slush' moulding techniques, such articles having specific advantages in their application to moulded footwear articles. The production of such cellular articles merely involves the inclusion of a blowing agent in the plasticol, the latter mixture being introduced in the second filling of the mould. The curing stage therefore involves heating of the two layers above their respective points of fusion. The plasticol containing the blowing agent has a reduced viscosity to allow adequate blowing, and involves modifying the viscosity of the plasticol by the introduction of a wetting agent, usually of the polyoxyethylene type and non-foaming.

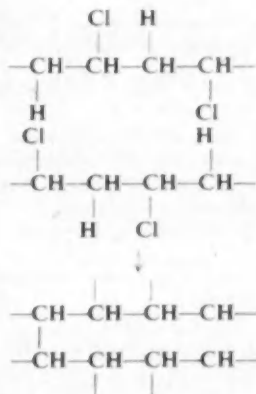
A method employed for the production of cellular products by 'Slush' moulding utilises the following recipe in the initial filling stage.

Polyvinyl chloride	..	..	100 parts
Diethyl phthalate	..	..	41 "
Diethyl adipate	..	..	15 "
Polyester resin	..	..	14 "
Stabiliser	..	..	0.3 "
Pigment	..	..	1 "

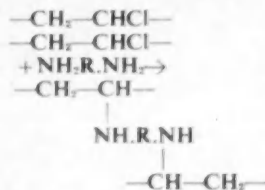
After decantation in the first operation, a plasticol containing the above recipe is modified by the addition of a blowing agent [5 parts of a mixture of dinitrosopentamethylene diamine (40 per cent) and inert material (60 per cent)] and again introduced into the mould and the process repeated (6). The viscosity of the plasticol containing blowing agent is about 2,500 centipoises at 80° C. The viscosity of the plasticol at the initial filling is about 800 centipoises at the same temperature.

The use of polyamines in cross-linking for polyvinyl materials does not appear to have been investigated in 'Slush' moulding techniques. The auto-curing of polyvinyl chloride is a mechanism probably involving the elimination of hydrogen chloride between adjacent chains as suggested below. The tightness of the linking suggesting good heat and tear characteristics, cross linking between the chains being based on the arrangement of the polymer in the most sterically favoured positions, the halogens thus arranging themselves as shown.

Although comparatively high tensiles may result from such cross-linking, improved



flexibility might be envisaged, if curing were effected using suitable diamines, so obtaining products with intervening polymethylene amino cross links, the plasticity of such systems being broadly a function of the number of polymethylene groups in the cross-linking agent, the greatest reinforcing effect being obtained, using the simpler di- and triamines. The simpler triamines would possess maximum reinforcing characteristics of the polyamines used. The polyamines could be used as solutions in suitable plasticisers, before the initial filling stage in a 'Slush' moulding operation.



The properties of polyvinyl products using polyamide plasticisers, as for example those prepared from the copolymerisation of homologues of Leuchs' anhydride and 11-aminoundecylic acid (anhydrocarboxy-dl-leucine, anhydrocarboxy-l-glutamic acid, etc.) (8) may have applications in sundry moulding techniques.

Pipes and valves have been made by filling moulds with plasticols containing dibutyl phthalate (9); the layer contiguous with the surface of the mould is gelled, the ungelled supernatant liquid being decanted and the liner cured between 32 and 65° C. The mould is preferably heated before introduction of the plastic mass, the initial coat-

ing of the mould surfaces with high boiling plasticiser facilitating stripping of the piece.

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- (4) BP 672122.
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- (6) BP 725100.
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Record Year for Canada

Production Increased : Imports Down

CANADA's chemical and allied industries set a new production record in 1954 when the factory value of shipments grossed \$921,100,000; 4.5 per cent above the previous peak of \$881,500,000 in 1953. This increase was a continuation of the upward trend which has been a feature of this group of industries since the war.

The output value of chemicals and allied products has more than doubled since the war and is more than five times the value recorded for the best pre-war year. Production value was \$160,000,000 in 1939 and \$376,000,000 in 1946. Higher values were recorded for 10 of the 14 industries in the group, primary plastics leading with a rise of 13.2 per cent, heavy chemicals next at 12.6 per cent, toilet preparations 6.9 per cent, adhesives 5.8 per cent, polishes 3.6 per cent, soaps 3.3 per cent, inks 3.2 per cent, compressed gases 2.8 per cent, and medicinals 0.6 per cent. The miscellaneous group had an increase of 13.1 per cent. The value of the fertilisers group declined 1.1 per cent, vegetable oils 5.9 per cent, coal tar distillation 5.6 per cent and paints 3.1 per cent.

Despite greater and more varied production in Canada, the imports of chemicals and allied products continued to account for a substantial part of the total supply. The value of imports in 1954 amounted to about \$220,000,000, a little lower than the \$222,000,000 total for 1953.

Purchases from the US amounted to \$190,000,000, representing 86 per cent of the total. Supplies from Britain were valued at \$19,000,000 or 9 per cent of the total, while purchases from other countries totalled \$11,000,000 or 5 per cent. Imports of drugs and medicinals were valued at \$25,000,000; paints and pigments \$20,000,000; fertilisers \$12,000,000; dyeing and tanning materials

\$10,000,000; acids \$6,000,000; explosives \$2,000,000; and soaps and toilet preparations \$1,000,000.

Commercial Kojic Acid

KOJIC acid is being produced commercially for the first time outside Japan, where it was isolated by Japanese research scientists almost half a century ago, the Pfizer company announces. A spokesman of the company in New York says, however, that it is not available for export abroad at this time.

Kojic acid is an active chemical compound used as a base in making cosmetics and dyes, which Japanese researchers 50 years ago initially isolated as a by-product of the fermentation of steamed rice, and now becomes the latest product in Pfizer's new series of fermentation-produced industrial chemicals.

'Kojic acid is a multi-functional molecule which will prove important to many industrial chemists', according to Mr. Allen J. Greene, director of the firm's commercial development programme. 'Kojic acid reacts at every position of its structure'.

Researchers have found that this new chemical compound has some bacteriological action, inhibiting the growth of *streptococci*, *staphylococci* and *sheigella paradysenteria*.

Kojic acid also forms insoluble salts with heavy metals such as copper, iron and zinc. Other salts and metal complexes of Kojic acid have been prepared containing sodium, barium, calcium, strontium, tin, mercury, cadmium, manganese, aluminium, lanthanum, proserodymium, neodymium and samarium.

Enterprise Awards

WORKERS employed by the Consolidated Mining & Smelting Company of Canada Ltd. are encouraged to submit suggestions for improving efficiency in the company's activities. Called 'Suggestion Plan Awards', the recent list issued by Cominco shows that nearly \$1,000 was paid to employees for practical on-the-job suggestions.

Highest award was \$250 to Mr. C. R. Saare, of the Warfield phosphate plant, for an idea for installing a condensate trap to collect acid. For suggesting the use of large combined boxes on phosphate plant agitators another employee of Warfield was awarded \$70. It was his 20th award under the plan.

Solvent Extraction Plant

New Techniques in Arkansas Vegetable Oils Process

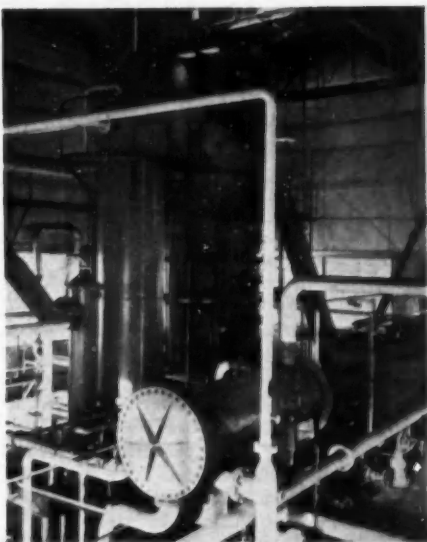
THE Southern Cotton Oil Company has recently completed a new solvent extraction plant at Newport, Arkansas, US. This plant is of particular interest because of its layout; that of the process equipment has been arranged so that it can handle cottonseed and soyabeans, either together or separately.

The company's engineers thought that substantial savings could be made by reappraising old accepted methods and layouts, and adopting a new technique. Their main considerations were to reduce initial investments and improve processing control. Emphasis was placed on the production of the highest quality meal. In other words, the goal was to obtain the best products and production layout at the lowest cost. The company believes that the Newport plant achieves a great measure of success in this respect.

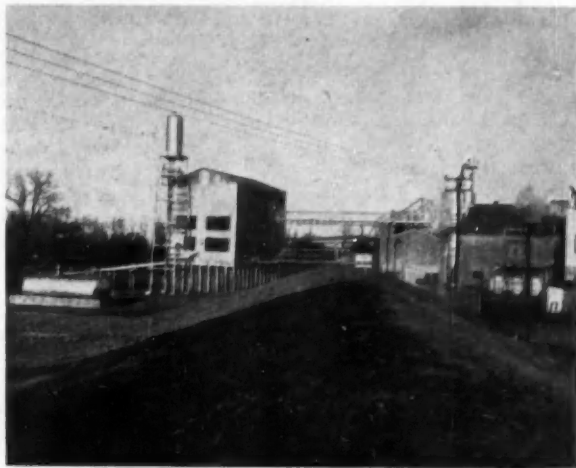
Simplification of the preparation area was accomplished by installing old hydraulic cookers on 13 ft. legs and feeding directly into expellers. The bin which acts as primary feeder for the process was redesigned with variable-pitch screws and a variable drive. The soyabean cracking rolls are arranged so that they serve to reduce cottonseed cake when running prepress solvent flow. The conventional flaking rolls were

replaced by German-built rolls at a substantial saving in cost. The single line flow greatly reduces transmission and installation cost. All buildings are of the prefabricated type and the plant was erected on concrete piling.

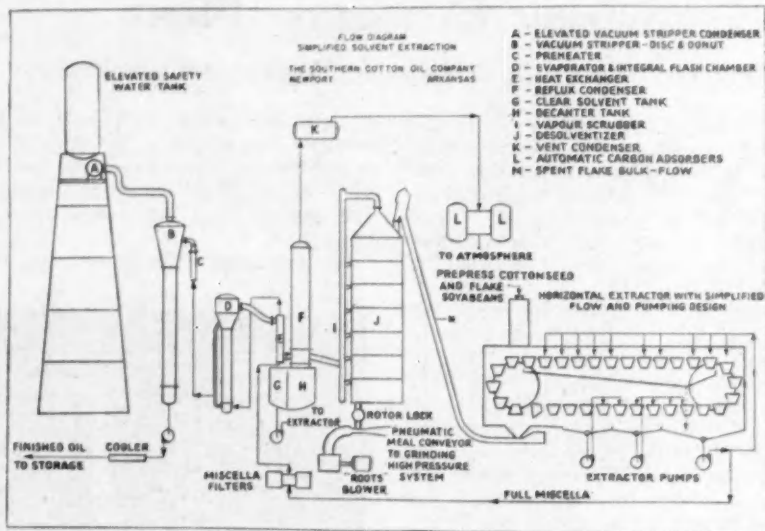
The extraction plant consists of a hori-



Top right: Interior view of extraction plant, showing vent and reflux condenser with D-T in background



Right: An exterior view of the plant and boiler house



zontal extractor, desolventiser toaster and distillation equipment. The piping has been reduced by 40 to 50 per cent over conventional plants, and the extractor requires only three pumps for solvent distribution. The distillation units were also extensively redesigned; they were relocated, and large vapour piping was reduced to a minimum. A single large reflux condenser serves for both the oil distillation and D-T vapours. This reflux condenser is arranged so that it is an integral part and is supported by the decanter tank. In this way, condensate piping is eliminated.

Because of the large condensing load there is always a good flow of solvent draining back on the inside of the tubes and in this way any accumulation of fines is eliminated. A water spray is fitted in the top of the condenser; this adds contact condensing capacity and helps to clean the tubes. A vent condenser is located on top of the extractor and only one vent line is required from the top of the reflux condenser.

The safety water tank, which operates in the event of a power failure, is placed on a separate elevated support adjoining the extractor plant. Directly under the safety water tank there is a platform supporting a vacuum stripper condenser. The solvent recovery system consists of carbon absorp-

tion towers which are operated automatically. The advantages of automatic operation are that the cycle times can be varied whenever the vent gas concentration increases and the operator need not spend his time changing towers. The company considers that the operator's time can be utilised more profitably by watching other phases of the operation.

All process controls are shown on a central control panel. The operator can watch the complete process, with the exception of the extractor, from the floor.

The meal grinding system has Entolter impact machines as primary reducing units. These machines are used in preference to conventional-type hammer mills because they can reduce the particle size with half the amount of fines conventionally made. Screening operation and aspiration were included to separate different fractions, so that a uniform dust-free meal is produced.

Insecticide Rushed to Cairo

Two freight planes chartered by the Egyptian Government left Manchester Airport for Cairo on Wednesday, 13 July, with 150 tons of concentrated insecticide to be used to combat sudden infestation by insect pests in the cotton fields.

The Immedium Filter*

New Development by Dutch Company

FILTRATION is said to take place when a liquid passes through a wall of porous material and solid impurities are removed. The wall may be of filtercloth on a support or sand or some similar material.

Generally the liquid first passes a medium with the finest canals or pores, the supports having generally coarser interstices. The filtering layer may be thin or of considerable dimensions. An example of the last case is the well known sandfilter. Generally its composition consists of a solid support with holes of considerable dimensions. On this support gravel of various dimensions is placed, diminishing towards the top. This is also the case for the layer of sand, which is found on the gravel, the finest sand is at the surface of the bed. Filtration always takes place in a vertical direction from the top to the bottom of the filter; it would be impossible in the opposite direction, for the bed of gravel and sand would burst and impure liquid would pass without any filtration.

It is well known that the bed must be cleaned if it is clogged, and this manipulation is always done with the aid of water or air or a combination of both. For a successful cleaning the grains of the bed must float in the stream of liquid which serves for this purpose; it is quite clear that this stream must pass with a considerable speed through the bed. Cleaning it is not possible otherwise. Therefore after the cleaning in the bed we will always find the finest particles at the top of the bed, the coarsest grains on the bottom.

Course Reversed

It appears that normally the liquid which must be filtered first passes the part of the medium with the finest canals or pores. However, in the Immedium filter, which is described in this communication, the liquid goes from the coarsest canals to the finest. Its construction was based on the supposition that this is a better way of filtration. Practical results with the filter went beyond the most optimistic expectations. They were obtained with liquids, which could not otherwise be filtered by known methods.

From the preceding it follows that filtra-

tion must take place in the upward direction and this has been attained by placing a draining system in the part of the bed which consists of the finest grains, i.e. in the upper part of the bed. This construction is the most practicable for industrial filters, but it is impracticable for laboratory purposes. In the latter case turning the cleaned filter is recommended so that the coarsest particles are found on top, or gradually removing the bed by water to another filter. In both cases it is possible to filter in a downflow direction and a special drain system is not necessary.

The principle of the Immedium filter is shown in the diagram on the following page, which is of a small industrial filter. The filter (1) is of the closed type and will stand up to a considerable pressure. On a support plate (2) with quadrangular holes is placed a layer of gravel which cannot pass through the holes. The size of this gravel diminishes towards the top. Above this is placed the filterbed of sand (3). The drain (4) is in this case of a cylindrical form. At (5) the effluent is evacuated and at (6) and (7) liquid and/or air may enter. On top of the filter a decanter is placed, the purpose of which will be discussed later.

In filtering liquids, which contain very coarse particles, e.g. straw, pieces of wood, vegetable matters, etc., the holes of the support plate may get clogged. As this filter always works in upflow only, these particles would never be removed. Therefore it is necessary to pass water in downflow from time to time through the filter to remove this accumulation of matter; for this purpose an outlet must be provided. The liquid, however, may also be roughly screened before entering the filter. It is useful to have this opportunity to filter in downflow as one can compare the two systems of filtration (downflow-upflow).

In every cleaning operation it is further necessary to introduce for at least a minute rinsing water inside the drainage system.

**Manufactured by Industriële Maatschappij Activit n.v. of Amsterdam, who have sent us this communication.*

This must be done before the end of the cleaning operation—before the bed is settled—otherwise a hole would be blown in the bed.

Most important is a correct cleaning operation of the filterbed. For a downflow filter at least during part of this operation all grains of the bed must float separately in the stream of the rinsing-water; this may be easily controlled by passing a pole through them. However, it is a fact that in practice few filters will give a satisfactory result. Most of them contain considerable parts of the bed clogged together, which parts are of no use in filtration.

The Immedium filter may be operated with a speed of filtration that is considerably greater than for an ordinary filter. Practical results, e.g. for filtration of river-water gave a proportion of 1:2 to 1:4. To carry out the cleaning operation perfectly in a short time, this operation for the upflow filter is done in practice, so vigorously, that a decanter on the filter for most purposes is necessary. In the construction of the design, air first of all is separated from the

liquid when entering the decanter and then the direction of the stream is changed, so that particles of sand which have been carried along are returned to the filter. For this purpose other constructions, e.g. cyclones may be used.

In an ordinary sandfilter generally only the grain size of the upper parts of the bed is of importance. However, for the upflow filter the size of every grain of the bed is important. A specific problem of filtration may ask for well-specified grain sizes of the sand. It has been found very difficult to obtain this material; moreover if sand is the most ordinary filter medium, often far better results are obtained with other materials, e.g. grains of coke or coal.

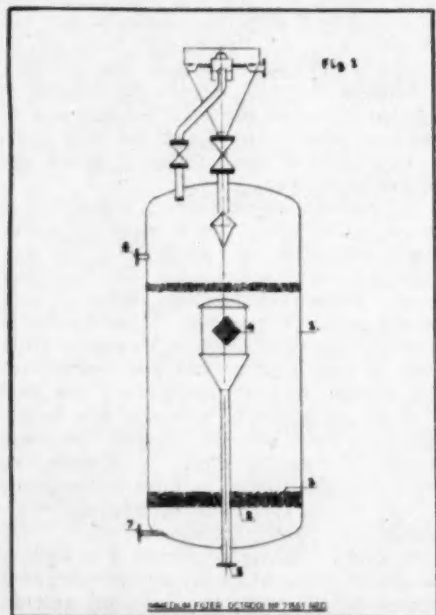
Not only ordinary filtrations, which up to now always take place with filterpresses, sandfilters, rotating filters, etc., may be successfully executed by an upflow filter, but ultrafiltration, even removal of bacteria is quite possible.

Particulars are given below of two kinds of filtrations to show the possibilities of the new system, with water and juices of a beet sugar factory. They all were done with filters of the same dimensions, but with different kinds of filter media.

The filter had an inside diameter of 690 mm., 2,000 mm. between top and bottom. The support-plate had holes of 20 by 3.5 mm., their pitch was 37 mm. On this support were some layers of gravel of diminishing grain size to the top, a layer of 100 mm. of 5-8 mm. grainsize, 80 mm. of 3-5 mm., and 80 mm. of 1-2 mm. On this layer of gravel the filterbed was placed. Three different kinds of bed were used, coarse sand (A), fine sand (B) and grains of coal (C). Figures about these materials are given below:

	A	B	C
	coarse sand	fine sand	coal
Diameter of mesh			
over 1.2 mm.	25%	—	—
between 1.00—1.2 mm.	24%	—	—
" 0.7 — 1.0 mm.	21%	—	4.0%
" 0.5 — 0.7 mm.	12%	—	60.5%
" 0.3 — 0.5 mm.	9.5%	—	22.0%
" 0.25 — 0.3 mm.	7.5%	7.5%	6.0%
" 0.20 — 0.25 mm.	1.0%	11.0%	4.0%
" 0.10 — 0.20 mm.	—	75.0%	3.5%
lower than 0.10 mm.	—	6.5%	—

The filter has a cross section of 0.38 mm., the bed is 1,250 mm. thick, thus there is 480 l. of filter material. The draining body has a surface of 0.24 mm. and may be covered with different screens, copper 30 by 40 thread thicknesses 0.37 mm. or Morel-metal 36 by 36, 5 threads 0.16 mm., 8 threads 0.115 mm.



1. The filter casing. 2. Support plate. 3. Sand filterbed. 4. Drain. 5. Outlet for effluent. 6 & 7. Liquid and/or air inlets

Tests with water were performed with surface water from the port of Amsterdam which often has a very bad composition as regards turbidity. In these series of tests an ordinary filter of the same dimensions was used for comparison; both filters were filled with a bed of composition A. Some results of these tests are reproduced below. These tests were run with a bed that already had been used several times. This applies also to the results obtained with sugar juices.

Number of test	Quantity of effluent	Duration of run	Turbidity removed
1 Ordinary filter	16 l.	2 min.	80-82%
1 Immediate filter	455 l.	59 min.	78-83%
2 Ordinary filter	20 l.	5.5 min.	80%
2 Immediate filter	500 l.	52 min.	80%
3 Ordinary filter	14 l.	1.25 min.	78-80%
3 Immediate filter	453 l.	29 min.	78-80%
4 Ordinary filter	13 l.	1.05 min.	—
4 Immediate filter	425 l.	29 min.	—

Final loss of head was 20 m. Turbidity was determined by the standard APHA Jackson turbidity meter method.

In the test with sugar juices four kinds of juices were filtered, raw juice, juice to which lime was added to pH 10 to 11, juice acidified to pH 3.6-4 and second carbonation juice. With the exception of second carbonation juice, filtration of the juices over filter presses or similar apparatus is next to impossible.

The experiment were made during the last investigations at the Friesch Groningsche Coöperative Beetwortelsuikerfabriek, at Groninger (Holland). Much time was lost to overcome technical difficulties of secondary importance and the results only give an impression of the possibilities of this system of filtration.

Raw juice filtration has been carried out at a temperature of 90° C with the three different kinds of bed, but only in the case when the composition B was used have satisfactory results been obtained. Two representative sets of figures are given below. The filterbed is composed of the material A (coarse sand).

Loss of head	Quantity of effluent	Duration of run	Limpidity
0.15 atm.	800 l.	32 min.	No difference by visual inspection.
—	1,600 l.	60 min.	—
—	2,400 l.	100 min.	—
—	3,200 l.	128 min.	—
—	4,000 l.	165 min.	—
—	4,800 l.	198 min.	—
—	5,600 l.	235 min.	—
0.25 atm.	6,400 l.	265 min.	—

The slight increase in loss of head and only a small deposit in the untreated juice which is not present in the effluent after 15 minutes of sedimentation indicates insignificant purification.

The filterbed is composed of the materials A and B, in the proportion of 1:6.

Loss of head	Quantity of effluent	Duration of run	Limpidity
1.5	800 l.	20 min.	In a test tube the effluent appears as a light yellow liquid.
3.1	1,600 l.	39 min.	—
4.0	2,400 l.	61 min.	—
4.4	3,200 l.	80 min.	—
4.5	4,000 l.	100 min.	—
3.1	4,800 l.	125 min.	—
4.0	5,600 l.	143 min.	—
4.6	6,400 l.	162 min.	—
4.8	7,200 l.	182 min.	—
4.9	8,000 l.	205 min.	—
4.7	8,800 l.	233 min.	—
4.9	9,600 l.	261 min.	—
5.0	10,400 l.	—	—

pH of influent and effluent is practically the same.

By pilot experiments it was found that:

(a) Unheated raw juice was exposed to an intense biological action resulting in a drop of pH to 3-4 and formation of invert sugar by the presence of bacteria in the impurities separated by the bed from the juice. The remarkable purification of the effluent was due to the removal of colloids at their iso-electrical point.

(b) Filtration of raw juice over a bed of fine pulp gave no favourable results. These experiments have not been continued with other edible agricultural wastes, no time being available. With prelied juice better results were obtained, though they are not yet sufficiently good.

Experiments with raw juice at 90° C neutralised to pH 7 with Na_2CO_3 gave practically the same results as for unneutralised juice.

The following results were obtained with juice of 90° C of pH 10-11 by the addition of CaO. The filterbed is composed of the materials A and B, in the proportion of 3:1.

Loss of head	Quantity of effluent	Duration of run	Limpidity
0.2 atm.	800 l.	35 min.	Excellent
1.5 atm.	1,600 l.	55 min.	—
3.5 atm.	2,400 l.	80 min.	—
5.0 atm.	3,200 l.	125 min.	—
5.3 atm.	4,000 l.	220 min.	—

The pH of influent and effluent was practically the same. It was too low and varied between 10-10.3. However, filtrations at a higher pH had practically the same results.

It is necessary to use a pump giving higher pressure to speed up filtration at the end of the run. It is possible that a smaller loss of head is obtained by increasing the filtering surface of the drain. In using grains of coal, in the beginning the loss of head was less, but no difference was found at the end of the run; the results are identical. Therefore it is quite certain that no more than nine volumes of this kind of juice may pass

one volume of the bed. The volume of the sediment is considerable—about 7 per cent may be obtained by centrifugation—and the interstices in the bed may only contain this quantity in case of contraction of the sediment in the filter.

We have also determined the quantity of the sediment that is obtained, if raw juice of about 30° C is brought to a pH 3.6-3.8 by adding of acid. The sediment is considerably less, and was no more than 2 per cent on raw juice, which sediment equally may be easily removed by the Immedium filter. It is probable that this way of pre-purification is interesting not only to obtain the use of less CaO in the ordinary way of purification, but equally to obtain a simpler way of treating juice by ion-exchange, the expensive cooling of the juice, always proposed for this way of purification, which is an unsurpassable inconvenience can be prevented in this way.

Finally the figures of a test with second carbonation juice are reproduced, which suggest that the Immedium filter can replace ordinary filterpresses without any difficulty.

The bed consisted of the materials A and C in the proportion of 4:1.

Loss of head 0.5 atm.	Quantity of effluent	Duration of run	Limpidity Excellent
No remark- able increase	800 l.	after 18 min.	Excellent
	1,600 l.	36 min.	"
	2,400 l.	54 min.	"
	3,200 l.	1 h. 12 min.	"
	4,000 l.	1 h. 30 min.	"
	4,800 l.	1 h. 48 min.	"
	5,600 l.	2 h. 6 min.	"
	6,400 l.	2 h. 24 min.	"
	7,200 l.	2 h. 42 min.	"
	8,000 l.	3h.	"
	8,800 l.	3 h. 18 min.	"
	9,600 l.	3 h. 36 min.	"
	10,400 l.	3 h. 54 min.	"
	11,200 l.	4 h. 12 min.	"

Nowhere results in the preceding lines are reproduced for the ordinary method of filtration in downflow of juice. However, several times this method of filtration has been applied, always with negligible results. Often, even after some minutes, the upper layer of the bed was clogged, especially when using fine sand.

The sweetening off of the bed was possible without difficulties. The water that was used for this purpose could be passed in several directions through the bed, in upflow, in downflow, from both sides to the drain and from the drain. It is not yet clear, which is the best way of operation, all methods were found to be possible. It is, however, of great interest to first use steam for removing the juice from the bed.

The author is aware that he has only superficially touched the numerous aspects of the way of filtration described in this communication; they should be examined in detail. He hopes, however, that it may lead to the interest in a new execution of a primary operation in technics.

Lac Monopoly Challenged

DESCRIBING lac as a complex product resulting from the biological inter-action between the sap of trees and the lac insect, Dr. Punjab Rao Deshmukh, Union Minister for Agriculture, told delegates at the recent Lac Conference in Simla that India's monopoly of this product was being challenged.

In recent years India's lac production has fallen steadily from 1,296,000 maunds (one maund = 82.3 lb.) in the year 1951-52 to 654,000 maunds in the year 1953-54. Despite competition from synthetic substitutes, the overall demand for lac, seedlac and shellac has not fallen.

Reasons given for the decrease in production of lac were the failure of crops and shortages of sticklac, the raw material. Fluctuating prices attributable to reckless speculative activity had also barred the way to increased production. To counter this the Government of India has banned the speculation in lac under the Forward Markets Regulation Act.

Saying that the production target of lac by the end of the second Five-Year Plan had been fixed by the Government at 1,700,000 maunds, Dr. Deshmukh informed delegates that it was intended to set up an Export Promotion Council.

Organic Structures

STRUCTURES of some 53,000 organic chemicals have been encoded by the Chemical-Biological Co-ordination Centre, 2101 Constitution Avenue, Washington DC. These codes have been entered into IBM machine sorted punch cards. Tables representing an analysis of the punched card files of structure information are available at the centre. These were prepared to aid those who wish to devise indexes or other ordering schemes and who would like to determine the frequency of occurrence of various structural features of compounds.

Paper from Banana Stems*

Cheapest Raw Material for Pulp

IN 'World Pulp and Paper Resources and Prospects', a survey prepared by the FAO in co-operation with UNESCO, the ECE and the ECLA, it is said (see p. 64) that, 'banana stems and abaca leaves have been tested and found suitable for the production of paper and board.'

In 'Tropical Woods and Agricultural Residues as Sources of Pulp' (papers presented at the fifth meeting of the FAO technical committee on wood chemistry, Appleton, Wisconsin, US, September, 1951) it is also said that (see p. 147), 'it is well known that the fibre pulp (abaca) is now used as blends with wood fibres to make the strongest of our bag and wrapping papers. These fibres, as well as bast fibres, are used in the manufacture of bank notes, and high tear and scuff resistant papers'.

Other quotations from 'World Pulp and Paper Resources and Prospects' say that in the Philippines, 'the most promising of the various prospects discussed is a pulp mill at Davao which uses abaca waste' and that in La Perla, Costa Rica, there is a mill 'with a planned capacity of 3,000 tons a year, production being based entirely on abaca waste supplied by two local abaca cleaning factories'.

London Firm's Confirmation

The La Perla mill was installed after Liddon & Co., London, had verified that paper made with 100 per cent abaca fibre is stronger than that manufactured with 100 per cent craft. It was built by the Pulp & Paper Research Co. Ltd. under Parsons & Whitmores private four point programme.

After cutting the stalk close to the ground the leaf top is cut off and the splits removed. Hand splitting yields about 7 to 12 lb. of fibre from each stalk, which amounts to approximately 2 per cent of the total volume of the pulp plant. Splitting, which is usually done in the field, begins at the base of the stalk and entails the removal of about three sections from each sheath. The discarded sheaths and pulp are left to rot and manure the soil and the 'splits' are taken to a central site for stripping, i.e. the removal of excess pulp from the fibre.

The industrial exploitation of abaca

(*musa textillos*) fibres as raw materials for the production of paper suggests the possibility of using the *musa paradisiaca*, *musa sapientum* and other *musa*, which, contrary to the abaca, bear fruit. Each *musa paradisiaca* or *musa sapientum* produces after 12 to 18 months a cluster of bananas and it is necessary to cut down the plant immediately this cluster is picked.

Like the abaca plant they contain less than two per cent fibres, but these fibres can be disintegrated and pulped so easily and so cheaply that they become the most economical raw material for the papermaking industry.

Caustic Treatment Unnecessary

In contrast to abaca fibres, treatment with caustic soda is unnecessary and inadvisable. Using the patented Vasconcellos or Batex process it is possible to obtain a pulp of the stems and leaves of the banana plant without making use of heat, high pressure or caustic soda. It is unnecessary to build new pulping mills because the pulp can be manufactured in the paper mill using the normally available hollanders or breaking and washing machines.

The banana plant is cut, and the stem immediately divided into strips. The strips are then placed in a shelter covered with straw where they are allowed to dry, or till they contain only 30 per cent of water. This makes possible a substantial reduction in transport costs.

Log wood requires considerable mechanical treatment before it is ready for pulping. On the contrary the bagasse fibres from the banana plant are immediately ready for chemical treatment. They are extracted and bleached by two mechanochemical treatments, the first with five per cent sodium carbonate solution which can be used three or more times, and the second with a chloride of lime solution of five per cent or less.

The yield of fibre is low but this is compensated by:—

*Based on information supplied by Dr. Alcides de Barros e Vasconcellos, Rua do Rosario, 129-1^a andar, Rio de Janeiro, Brazil.

(1) The profit in the selling of the banana fruits.

(2) The cheapness of the Vasconcellos process for the extraction of pulp.

(3) The low investment for the installation of the two machines necessary for the extraction and pulping of the cellulose.

(4) The ease of transportation of the raw material.

(5) The possibility of producing the raw material next to the paper mill.

(6) The possibility of pulping the fibres in beaters at the paper mill.

As a general rule pulp mills must be located near their main supply of raw materials since the cost of transportation is usually prohibitive. There are a great number of banana plantations near the paper mills in Sao Paulo and Rio de Janeiro, and in addition the banana plant can be cultivated near any Brazilian paper mill.

The advantages of the Vasconcellos process can be demonstrated by a study of the costs of collection, transportation, chemicals, etc., involved in the process. These costs have been worked out for *musa chinensis*, which is the lightest of the banana plants. To obtain one kilogram of pulp it is necessary to use 3.3 stems of *musa chinensis*.

After allowing for all factors the minimum profit on pulp sold in the US is 66 per cent. On top of this profit must be added the profit made on the selling of bananas.

In making these estimations the maximum possible expenses have been assumed in each case. It would, for example, be possible to use some of the chemicals more than once, thus making considerable reductions in costs.

Nobel Prize Winners in Bonn

NOBEL prize winners in natural sciences heard Professor Werner Heisenberg, of Göttingen, discuss plans for a West German atomic research station at their international meeting in Bonn on 12 July. Among those who attended the meeting which was devoted mainly to chemistry were 16 Nobel prize winners from Europe and North America, German and foreign academic scientists, and representatives of the German chemical industry. Representing Britain was Professor Frederick Soddy, winner of a Nobel prize for chemistry in 1921.

Professor Heisenberg spoke critically of West German plans for atomic development.

The first task for Germany, he said, was to make up the lead established by other countries in atomic science and technology. The most practical way being to first build an experimental station which should consist of one or more experimental reactors, an institute of neutron physics, another for chemistry, and a series of workshops, in particular for electronics.

Bradford Chemistry Courses

IN conjunction with the Yorkshire Council for Further Education the Bradford Education Sub-Committee is arranging courses of lectures on general chemistry and properties of organic high polymers entitled 'High Polymers', and on theories of colour, colour measurement and colour assessment entitled 'Colorimetry', to start in September. Both courses are designed to present developments in the general chemistry and physical chemistry of high polymers (particularly the synthetic man-made fibres), and of colorimetry.

The course on 'High Polymers' will comprise 26 lectures by Dr. W. R. Moore, Senior Lecturer in Physical Chemistry at the Technical College, Bradford, where the courses will be held. The course on 'Colorimetry' also comprises 26 lectures which will be given by Mr. R. B. Bentley, Lecturer in Physical Chemistry. Each course may be taken separately and application forms are now available.

Crystallography Course

A COURSE in practical X-ray crystallography is to be held at Battersea Polytechnic, commencing on Tuesday, 11 October, 1955. Included in the syllabus are lectures, demonstrations and practical work totalling about 54 hours.

This course is intended for graduates and others with suitable qualifications who require practical experience in X-ray crystallography, and will include the operation of gas and vacuum X-ray equipment, use of standard X-ray cameras, single crystal, powder and back reflection methods, and interpretation of photographs.

The fee is £2 10s. and application should be made as soon as possible to the Head of the Physics Department, Battersea Polytechnic, Battersea Park Road, London S.W.11.

Sulphur Developments

Survey of the World Situation

THE British Commonwealth has become substantially less dependent on outside sources of sulphur in the last six years says the *Quarterly Bulletin* (June 1955, No. 9) of the British Sulphur Corporation Ltd. Nevertheless, the Commonwealth, which accounts for about 19 per cent of the total world demand, still has to import more than one-half of its needs.

Despite this lack of commercially exploitable deposits, the Commonwealth contains a large proportion of world resources in other forms, including pyrites and pyrrhotite, anhydrite, and sulphur in natural gas.

The sulphur crisis of 1951/2 gave considerable impetus to the development of processes for producing sulphuric acid from materials other than brimstone. Now that supplies of low grade elemental sulphur are readily available these plants are at an economic disadvantage, so much so that in Australia they are supported by a government subsidy.

Importance Will Increase

It is expected that in the next few years the Commonwealth will tend to assume an even greater importance in world sulphur trade.

Production of native and recovered sulphur in the US has decreased slightly. At the same time there has been an apparent rise in consumption. The reduction of stocks of native and recovered sulphur to a level about 155,000 tons below that at the end of March 1954, occurring at a time when substantial additions were made to productive capacity, is believed to be due in part to the deliberate policy of some producers.

The year 1954 was the most successful in the history of the Texas Gulf Sulphur Company, according to the annual report. Frasch sulphur production from the three operating domes accounted for 49½ per cent of the total US Frasch production. This was augmented by recovered sulphur production from the 100,000 tons per annum plant at Worland, Wyoming, treating natural sour gas.

It is difficult to obtain reliable information about the sulphur producing and consuming industries of the USSR. It does, however,

appear that the level of sulphur usage has increased substantially in recent years. Compared with the abundance of most raw materials there is a lack of major sources of sulphur supply.

Russia is one of the world's largest sources of natural gas, and some of the output from sour wells is being used to recover sulphur on a domestic scale.

In 1952 the Collins process for the desulphurisation of coke oven gas was installed on the coke oven plant at the iron and steel works of Stewarts & Lloyds Ltd., at Corby, Northamptonshire. The recovered hydrogen sulphide is converted to sulphuric acid of 60° Bé strength by means of a Chemiebau wet contact plant.

The coke oven gas is cooled to 20° C and scrubbed with a solution of ammonia to recover hydrogen sulphide as ammonium sulphide. The solution is then heated and the evolved hydrogen sulphide is burnt in a waste heat boiler to give sulphur dioxide which is then oxidised over a vanadium catalyst to sulphur trioxide.

Associated Engineers Ltd. of Calcutta have promoted the recently patented Elliott-Ludlow process for refining sulphur ores. This process is based on the use of a solution of CaCl_2 to separate sulphur from its gangue. Several plant manufacturers are reported to be examining the scheme on behalf of the promoters.

The world price of sulphur has remained unchanged, but because of the growing supplies of Mexican sulphur there is a downward pressure on prices. A major drop in world prices is not, however, expected, nor, it is believed, would it be a good thing as it might eliminate useful marginal sources of supply and discourage potential development.

Eire Oil Refinery Site

Eire is to have a new oil refinery at Whitegate, on the east side of Cork Harbour. Representatives of the oil companies concerned have for several weeks been considering various sites, and harbour options on a 1,300-acre site at Whitegate have been taken by Esso, Shell and Caltex.

Hercules Expansion

TO meet increasing demands for their range of rosin sizes in the North of England and in Scotland, the Hercules Powder Co. Ltd., of London, are to build a works at Pendlebury, Lancashire. It is planned to have it in production before the end of this year.

Rosin sizes from the new works will be available for delivery in bulk or drums, and first provision is to be made for the manufacture of paste size such as the recently-introduced Pexol fortified paste, and 'superior' grades of rosin size. Space will also be available for producing, at a later date, other of the company's projects.

When in production, the Pendlebury works

will lead to improved service to paper and board mills in the North and in Scotland in which areas the resources of an augmented technical service staff will be available.

Norwood Technical College

The 1955-6 prospectus for Norwood Technical College has recently been published. Both full and part time courses are available in a variety of subjects, including mathematics, physics and chemistry to degree standard as well as national certificate courses in several subjects. Enrolments should be made as soon as possible, and intending students should call at the college on any weekday.

Owing to the increasing complexity of designing and installing plant for the control and collection of dust of all types from industrial processes, W. C. Holmes & Co. Ltd. have found it necessary to expand the Elex section of their laboratory



Our photographs show two small corners of these new extensions. Facilities have been provided for particle size analysis, microscopic examination and the assessment of those properties of dust which are vital in the design of control and collection plant

Kappa Moisture Meter

Determinations Over a Wide Range

DETERMINATIONS of moisture content is often an important and difficult part of process control. The usual drying method permits normally the testing of only very small samples which are often not representative of the bulk of the product. Commercial moisture meters are effective usually for the somewhat limited range 5-25 per cent which is inadequate for a large number of materials.

An answer to this problem is claimed by Toplis, Simpson & Co. Ltd., Sunleigh Works, Sunleigh Road, Wembley, Middlesex. The Kappa moisture meter employs frequency-sensitive circuits to detect and measure small changes in capacity. The sample container is actually a condenser and the measurement made and recorded is a function of the increase of capacity of this condenser caused by the introduction of the sample.

Of all the substances likely to be present in the sample water makes by far the greatest contribution to capacity. The relationship between water content and capacity is, however, complex. At higher moisture contents the conductivity of the material becomes appreciable. This effect is minimised in the Kappa meter by the use of high frequency circuits.

The Kappa circuit operates at 10 Mc/s and its pointer movement—over a linear scale that can be coupled in turn to six moisture ranges—is claimed to be as nearly proportional to moisture content as it is possible to make it.

The meter is simple to operate. The sample is introduced and this capacity is exactly neutralised using the range buttons and pointer control. The neutral point is indicated by a neon lamp.

This new meter was developed as a result of research carried out in the laboratories of J. Lyons & Co., and has been developed in the light of comment and criticism from various commercial users.

Fire & Dry Rot Protection

FULL and permanent protection against flame and a preventive action against dry rot and insects may be obtained by treating wood, paper, cardboard and fibre board with Redicon M. This claim is made by Dr.

P. R. Masek (Research Laboratories), 2 Cairns Road, Battersea, London S.W.11.

Redicon M is an organic amino resinous polymer containing nitrogen-phosphorus groups. If applied to the surface of timber, plywood or hardboard it raises them to class one for 'surface spread of flame' (British Standard Definitions No. 476-1953).

For fully effective protection the total absorption of Redicon M has to be about 150 gm. per sq. yard. Application can be either by dipping or spraying. In spraying, the quantity to be applied has to be increased by about 25 per cent to make up for unavoidable losses. On the average one gallon of the solution will cover about 45 sq. yards.

There are certain limitations to the process. Redicon M is not effective on woodwork coated with boiled oil, oil paint, varnish or relatively fresh tar oil paint.

The effectiveness of the treatment may be recognised by holding a small chip from the treated surface over a flame. It should not burn but char superficially at the most.

If the treated surface is well dried, decorative coats of boiled oil, oil paints, lacquers and varnishes can be applied. Paints containing alkaline agents such as zinc oxide and chalk are not suitable; neither are nitrocellulose lacquers, emulsion colours or water wax stains.

Colonial Road Research

AFTER consultation with the Department of Scientific and Industrial Research, the Secretary of State for the Colonies has appointed a Committee to advise on matters of road research for the benefit of the Colonies. Dr. W. H. Glanville, C.B., C.B.E., D.Sc., M.I.C.E., Director of Road Research, has accepted the chairmanship of the committee.

Colonial Governments have indicated support for the establishment of a Colonial Road Research Section at the Road Research Laboratory to deal full time with road problems peculiar to tropical and rapidly developing Colonial territories. A Colonial Development and Welfare Research grant has accordingly been made providing funds to meet the cost of the establishment and maintenance of the section during the financial years 1955/57. The recruitment of staff for the section is in hand and it is hoped to commence work shortly.

I.C.I. at Dumfries

Continuous Production of Formaldehyde

IMPERIAL Chemical Industries Ltd. put into operation at their Dumfries factory in late June a new fully-controlled continuous-operation formaldehyde plant. This new plant, the result of co-operation between the Nobel division development research, operating and engineering departments, will produce 40,000 tons of formalin each year and will satisfy the needs of the pentaerythritol plant now nearing completion on the same site at Dumfries and the Ardil fibre factory in the same area.

It is of very modern design and incorporates devices for improved efficiency based on the working since 1947 of the present formaldehyde plant at Powfoot.

Instrumental Control

Most interesting feature of the development is perhaps the degree of instrumental control which has been incorporated in the plant. The raw material of the process, methanol, is brought from the company's Billingham division in rail tankers and is fed directly into the new plant from these tankers. It is vaporised and under control is mixed with compressed air, the mixture going to the convertor where the reaction takes place and the methanol is converted to formaldehyde. Gases are passed to coolers where their heat is removed for use in raising steam for another stage in the operation. Unchanged methanol is removed by distillation, recovered and passed back to the first stage of the process. Pure formaldehyde dissolved in water is stored in vast tanks for later use.

The whole process and all the units involved are controlled from a central point. This control room, now the most completely instrumented in the Nobel division, uses a control panel which has the pattern of pipelines and plant equipment laid on in colours, the picture colours agreeing with the actual colours used on the external pipelines of the plant.

The control operator has thus before him a complete picture in colour and line in the form of a flow-chart of the process, with controls in relation. By reading and interpreting the messages transmitted automatically from the plant he can tell exactly how

the plant is operating and make any minor adjustments necessary to ensure its continuous smooth operation.

Actual adjustments to the main external valves are made by turning the small knobs under each dial. The 34 dials on the flow-chart give continuous reports of conditions and are assisted by four continuous-recording chart instruments.

Only in the event of failure of the pneumatic operation of one of the main valves would it be necessary to go to the plant itself and operate the emergency valves by hand. Should any serious defect develop in the plant, alarm bells give warning and the plant automatically shuts itself down stage by stage in such a way that the danger of a gas explosion is eliminated. Attention has also been given in the design of the structure to allow safe and easy access for the maintenance men. Approaches to the various platforms are easy and more room has been provided for working than in some earlier designs.

The actual construction was undertaken by construction engineers of division HQ section and the instrumental work was done by the appropriate division HQ section.

More Wood Research Needed

BRITISH Columbia's Forest Products Laboratories have recently listed some of the processes calling for more research in the treatment of wood. The list emphasises that there are no cheap methods existing for making wood fire resistant, and that there is need for an inexpensive treatment which will make wood resistant to atmospheric changes.

Also required are cheap, long-lasting preservatives which will yield clean, readily-painted or easily glued surfaces; cheaper glues for laminating and prefabrication, and lower-cost resins for bonding.

Among the openings for industry in the Province, say the Laboratories, are: wood distillation, recovery of waste sulphite liquor for commercial alcohol, the manufacture of wood flour, the hydrolysis of wood waste to molasses or alcohol, and the production of extractives from bark.

HOME

New Address

The Paint Manufacturers & Allied Trades Association Ltd. have moved from 22 High Road, Chiswick, to 62 Putney High Street, London S.W.15. Tel.: PUTney 1735.

US Firm Seeks Scottish Factory

The Dunoon Town Council has received an inquiry from an American plastics firm which wants to rent a factory in Scotland. The council, desirous of bringing light industry to the town, is making every effort to find suitable accommodation. The name of the firm has not been announced.

To Boost Exports & Prestige

To promote exports and British industrial prestige abroad the Central Office of Information is to produce for the Board of Trade a regular Cine-magazine in which stories about British industry will be featured. A firm or association whose product is featured will meet the cost of filming the story. In return the Government will pay for foreign language versions, and for overseas distribution.

Kilmarnock Productivity Committee

The Kilmarnock Productivity Committee has changed its name to Ayrshire Productivity Committee. The purpose of the change is to widen the committee's scope, and bring in support from the whole of the county. Mr. Douglas Gardner, chairman since the inauguration two years ago, has resigned, and has been succeeded by Dr. J. Bell, of I.C.I. Ltd., Ardeer. Among the committee members is Mr. F. J. Warren, assistant works manager, Alginate Industries, Girvan.

Scots River Pollution

At a meeting of the Lothians River Purification Board on Thursday, 7 July, complaints concerning coal pollution of the River Almond, near Whitburn, and pollution of the River Esk by a discharge from a new coal plant at Smeaton were dealt with. It was stated that for the Esk, described by a member of the board as one of the worst polluted rivers in Scotland, the position had improved, and once the river inspector and his laboratory staff were established further improvements could be looked for.

Oil Facts

Statistics published by the Petroleum Information Bureau reveal that the demand for oil in Britain last year was greater than that of any other European country with the exception of Scandinavia. Consumption averaged 101 gallons for every man, woman and child.

New Offices

From 31 July the offices of The Pottery & Glass Trades' Benevolent Institution will be at 19 Portland Place, London W.1.

Technological Education

A 'Bulletin of Special Courses in Higher Technology' in the London and Home Counties area has been published by the Regional Advisory Council for Higher Technological Education, Tavistock House South, Tavistock Square, London W.C.1. This lists the various colleges in the area and gives an account of the special courses available.

Tar Distillers' Reorganisation

Yorkshire Tar Distillers Ltd., of Leeds, have effected a capital reorganisation in association with their principal suppliers of crude tar—North Eastern Gas Board, East Midlands Gas Board, National Coal Board (N.E. Division), and four coke oven companies. Contracts for the supply of crude tar on a pooling basis have been renewed and extended, and the suppliers have taken a 50 per cent interest in the controlling shares, which now stand in the name of the Yorkshire Tar Corporation as holding company of the group.

I.C.I. Fluon Plant Progresses

I.C.I. are making good progress with a new plant at Hillhouse, Lancashire, for the production of Fluon polytetrafluoroethylene. When completed, the plant will have a capacity of about 200 tons which will be achieved in two stages. The first stage, due in January next year, will mean that annual production of polymer will be stepped up from 25 to 100 tons. The final 200-ton stage should be reached later in the year. It is also planned to extend the present range to include an extrusion grade and special dispersions; and to reduce the price of Fluon later this year or by early next year.

OVERSEAS

Indian Plastics Progress

India is now exporting plastics products to more than 30 countries. The plastics industry which barely existed in India before the war has made tremendous strides and to-day there are more than 100 large factories operating. Export figures have been rising sharply—Rs.644,826 in 1951-52 to Rs.1,441,042 last year.

Value of Phosphate as Feed Supplement

Phosphate added to the daily ration of a group of dairy cows at the Bramley Research Station in Western Australia resulted in an extra 97 lb. butterfat average. The management and feeding were identical with those for another group which were not given the phosphate supplement.

India Considers French Offer

The French firm of Krebs has made an offer to install a fourth oil refinery at Bhavnagar, north of Bombay. The Indian Government is considering the proposal.

US Poison to Combat Australian Rabbits

Australia's Commonwealth Scientific & Industrial Research Organisation which began war on the rabbit pest a few years ago by spreading virus myxomatosis is to use an American poison called '1080' (sodium fluoracetate). The poison has been tested successfully in Tasmania. It is also hoped it will prove equally effective against the dingo dog.

Finnish Pesticides Figures

As a result of gamma-BHC resistance developed by flies, sales of household insecticides in Finland last year decreased by 50 per cent. The sales of arsenic and nicotine preparations also decreased. Facts, just issued, show that 18 companies were manufacturing and importing pesticides in Finland last year and that between them they marketed 32 different plant protecting chemicals, 136 insecticides, 18 weed-killers and nine preparations used as both plant protecting chemicals and insecticides.

Yugoslavia Buys British

Baird & Tatlock (London) Ltd. announce that they have received a contract for £20,000 to supply scientific instruments and apparatus for agricultural laboratories in Yugoslavia.

Mexican Sulphur

Foreign observers who recently visited the new sulphur wells in the Tehuantepec Isthmus were agreed that in the near future Mexico would rival Texas as an important world source of sulphur.

Record Aluminium Production

A record production of aluminium was set up by the French company Societe Pechiney last year. It produced 99,000 tons as against 92,000 tons in the previous year.

Duty-Free Imports

Fungicides, insecticides, fertilisers and herbicides can now be imported duty-free in Guatemala under a new Government Decree. The Decree (No. 315), came into effect on 16 June.

Nepheline Syenite Plant for Ontario

International Minerals & Chemical Corp. are to build a nepheline syenite plant at Blue Mountain, near Havelock, Ontario, at a cost of \$1,500,000. Mr. Louis Ware, president of the corporation, announces. The corporation controls deposits of about 30,000,000 tons of superior quality nepheline syenite, a high-alumina/high-alkali mineral, which is an important raw material for the glass and ceramic industries. It is planned to have the new plant completed by the end of this year.

Platinum-Group Metals

The US Bureau of Mines reports that the growing production potential of platinum-group metals last year resulted in declining prices despite continued demand. Total sales to domestic users rose nine per cent over 1953, and were the highest on record. Imports were five per cent down on the previous year. Demand for platinum for jewellery was sluggish, but this was more than offset by the expanding use of platinum as a catalyst for up-grading gasoline.

New Dutch Oilfield

A new oilfield has started production at Rijswijk, a suburb of The Hague. So far eight wells have been drilled, of which five are producing oil in small quantities. The total production of the new field is at the rate of 30,000 tons a year. The crude oil produced is transported along the canals for processing at Shell's Pernis (Rotterdam) refinery.

PERSONAL

At the annual general meeting of the Society of Chemical Industry at Birmingham on Tuesday, 12 July, it was announced that the following officers had been appointed for the year 1955-56: *President*, MR. JULIAN M. LEONARD; *hon. treasurer*, DR. E. B. HUGHES; *hon. foreign secretary*, DR. L. H. LAMPITT; *hon. publications secretary*, MR. F. P. DUNN; *hon. secretary for home affairs*, MR. E. L. STREATFIELD. Newly elected *vice-presidents* were MR. F. A. GREENE and DR. R. K. STRATFORD. The new members elected to the Council were MR. W. J. M. COOK of London, MR. E. M. MYERS, Newcastle, DR. W. G. OVEREND, Birmingham and DR. W. J. WORBOYS, London.

MR. JOSEPH DONALD NUTTALL, A.C.A., has been co-opted as a director of the Triplex Safety Glass Co. Ltd. He joined the company in 1946 from the Ministry of Aircraft Production and was appointed company secretary in January 1948. Since 1952 he has been a director of Quickfit & Quartz Ltd., interchangeable laboratory glassware manufacturers of Stone, Staffs, a subsidiary of the Triplex group.

After 37 years with The Pottery & Glass Trades' Benevolent Institution, Miss D. RUFFELL, the secretary, is retiring through ill-health. By an agreement with the Glass Manufacturers' Federation she will be succeeded as administrative secretary by MR. D. DRY. MRS. G. SAXTON has been elected *hon. secretary*.

MR. J. S. DUMERESQUE, who was on LORD LOUIS MOUNTBATTEN's staff in Ceylon and Malaya during the war, has been appointed general manager of Semtex Ltd. the Dunlop subsidiary. He was in charge of public relations, newspapers, films, broadcasting and censorship during the British Military Administration of Malaya. After retirement from the Colonial Service he joined the Dunlop Rubber Company.

MR. W. R. STOREY has been appointed technical adviser to the Gravier Manufacturing Co. with particular reference to industrial explosion suppression and protection.

The Geigy Co. Ltd. have appointed MR. B. H. DE C. IRELAND, M.B.E., B.A., to the newly created post of Editor, Technical Publications. For the past 10 years Mr. Ireland has been on the editorial staff of the *Manchester Guardian*, latterly as managing editor of the *Manchester Guardian Weekly*.

Before the monthly council meeting of The Association of British Chemical Manufacturers on 14 July, MR. J. DAVIDSON PRATT, C.B.E., M.A., B.Sc., M.I.Chem.E., F.R.I.C., the director of the association, and MR. ALLEN J. HOLDEN, B.Sc., F.R.I.C., the manager of the association, were presented with gold watches to commemorate their each having completed 27 years' service with the association. Before joining the association as general manager in 1928, Mr. Pratt was Chief Superintendent of the War Office's Chemical Defence Research Department.

MR. C. M. VIGNOLES, managing director of Shell-Mex & BP, has been elected a member of the Council of the Institute of Directors.

DR. KENNETH BULLOCK, Reader in Pharmaceutical Chemistry, has been appointed to succeed PROFESSOR HENRY BRINDLE as Professor of Pharmacy in the University of Manchester. Professor Brindle, who has held the chair since 1946, retires in September. Dr. Bullock entered Manchester University from Wigan Grammar School, graduated in 1923, and proceeded to the degree of Doctor of Philosophy in 1927. For several years he held a commercial post as a research and technical chemist, returning to the University in 1932.

MR. N. J. CAMPBELL, director of the National Paint Federation, is to attend the annual meeting of the Canadian Paint, Varnish & Lacquer Association to be held in Vancouver in September. Mr. Campbell will visit several paint factories in Canada before attending the meeting in Vancouver. Afterwards he will go to Washington to meet officials of the US National Paint, Varnish & Lacquer Association, then on to New York to attend the annual meeting of the Federation of Paint & Varnish Production Clubs.

MR. JOHN PURSER-HOPE, managing director of James A. Jobling & Co. Ltd. of Sunderland, has announced the appointment of MR. MILNER GRAY, of Design Research Unit Ltd., as design consultant. Mr. Milner Gray is president-elect of the Royal Designers in Industry and president of the Society of Industrial artists and he will work in close collaboration with the Jobling's design team headed by MR. JOHN COCHRANE. The Pyrex design programme will be steered by a committee of which MR. PETER RYDER, the commercial director, is chairman, and a very close interest is being taken by DR. SEAN COX, director in charge of scientific development.

At an extraordinary general meeting of the Royal Society for the Prevention of Accidents in London on 15 July, SIR HOWARD ROBERTS was elected president of the society in succession to SIR CHARLES BARTLETT, who resigned owing to ill-health. Sir Howard Roberts was previously chairman of the society's National Executive Committee, and also hon. solicitor, a post he held for 20 years. A request by Sir Charles Bartlett that he be permitted to continue as one of the vice-presidents, a position he formerly held, was agreed to by the meeting. Eight new vice-presidents were elected: LORD WALEREN, MR. S. R. GEARY, DR. J. STEWART, MR. L. E. MATHER, MRS. JEAN MANN, M.P., MR. PHILIP NOEL-BAKER, M.P., SIR JOHN ELLIOT and SIR EWART SMITH. Sir Ewart Smith is deputy chairman of I.C.I. Ltd. MR. FLEETWOOD SMITH, chairman of the National Publicity Committee, accepted office as hon. treasurer and MR. J. G. BARR, Solicitor to the LCC, was appointed hon. solicitor.

MR. JOHN E. MCKEEN, president of the international Pfizer Company, was honoured with three European awards in two different countries last week. In Athens, the Greek Red Cross president, GEORGE KOPOULOS, presented Mr. McKeen with the highest Red Cross decoration for his services to humanity in the fight against disease and for the donation of £2,000 made by Pfizer in May to Greek earthquake victims. With the award he also received a branch from the 2,500-years' old olive tree from the garden of PLATO. The same week, Mr. McKeen received from HIS HOLINESS THE POPE, the award of Commander of the Order of the Italian Republic, and a high Vatican medal.

A Year of Progress

Hardman & Holden Expand

FOLLOWING a policy of expansion Hardman & Holden Ltd., of Manchester, entered an agreement in December with the general chemical division of the Allied Chemical and Dye Corp. of the US under which they acquired the exclusive rights for the production and sale, under the trade name of Sulfan, of stabilised sulphur trioxide (stabilised sulphuric anhydride). Since the end of the financial year, 31 March, which resulted in a record output of their products, the company has acquired all the share capital of C. J. Schofield Ltd., manufacturers of sulphuric acid, salt cake and hydrochloric acid.

As the Schofield works adjoins the company's works at Clayton, the acquisition gives great scope for expansion. The company has also entered into an agreement with Chemische Fabrik Wesseling A.G., in Cologne, under which it is at present importing and developing a market for the range of silica fillers.

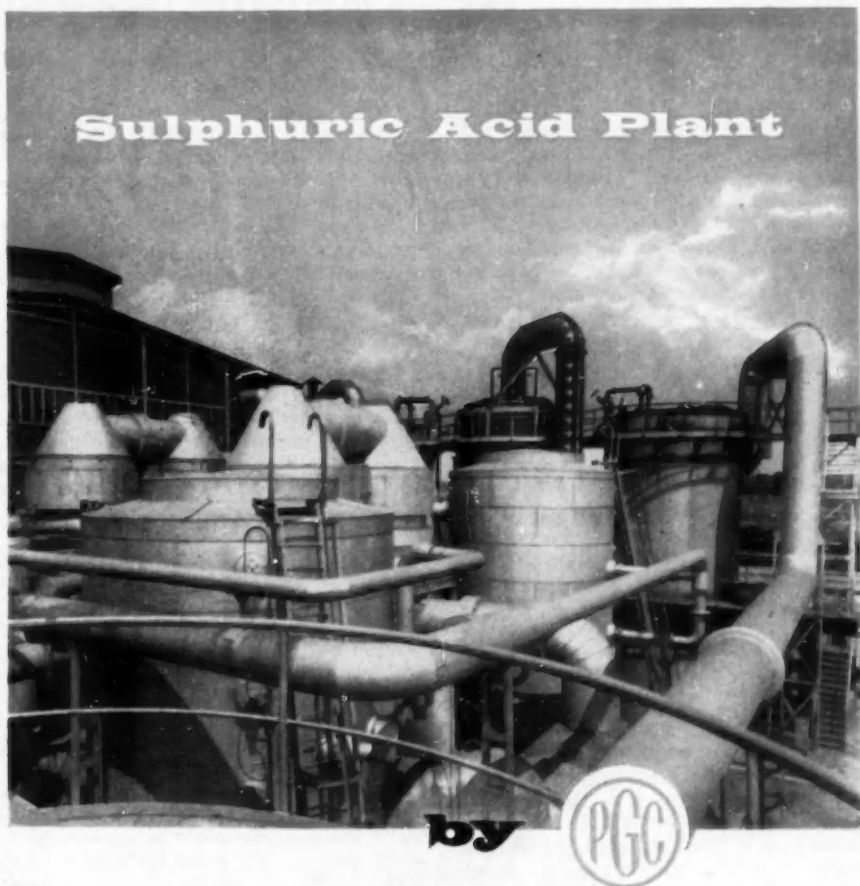
The trading profit for the year just ended, before depreciation, was £349,007 compared with £247,986 for the previous year. Net profit after tax and all other charges was £132,120 as compared with £90,990, and the directors recommend a final dividend of 12½ per cent.

In his statement, Mr. Kenneth G. Holden, the chairman, said that for the first two months of the current financial year, the demand for the company's products continued at a high level, and it is estimated that profits were slightly higher than those for the corresponding period last year.

Under the agreements made with regard to stabilised sulphur trioxide and silica fillers, the company proposes to manufacture Sulfan as well as silica fillers which are becoming important in reinforcing natural and synthetic rubbers, and plants for their production are being designed. Extensions are also being carried out at the carbon bisulphide and the insoluble sulphur plants, together with centralisation of the research staff.

Facilities for Gelvatol Polyvinyl Alcohol

Facilities for the production of Gelvatol polyvinyl alcohol costing \$1,000,000 have been completed at the Springfield, Mass., plant of Shawinigan Resins Corp.



We supply plant built to Chemiebau-Zieren designs for the production of sulphuric acid from all types of sulphur-bearing raw materials. Illustration shows a 70-ton contact unit utilizing SO_2 gases from zinc blende roasting furnaces.



THE POWER-GAS CORPORATION LTD
(PARENT COMPANY OF THE POWER-GAS GROUP)
STOCKTON-ON-TEES AND LONDON
AUSTRALIA — CANADA — INDIA — FRANCE — SOUTH AFRICA

Publications & Announcements

CONTAINED in the latest edition of *Review of Coal Tar Technology*, July-December 1954, is an account of some of the work that has been done by the Coal Tar Research Association, Oxford Road, Gomersal, near Leeds. Investigations are summarised on coal tar and coal tar products, including tar acids and bases, aromatic hydrocarbons and the utilisation of coal tar and its products, together with general chemistry and chemical technique.

* * *

REQUIREMENTS for a good floor polish are that it shall produce a smooth, glossy, readily cleanable, non-slippery surface. This physical contradiction can be partially reconciled by the use of Syton 2X it is claimed by Monsanto Chemicals Ltd., Victoria Station House, London S.W.1. A report issued by this company indicates some of the results that have been obtained by the use of Syton 2X in various polishes. Syton 2X is an aqueous colloidal solution of silica, and it has been found that the addition of 10 per cent by volume of this material in place of an equal amount of water gives good anti-slip properties.

* * *

LATEST edition of *Rubber Developments* (Vol. 8, No. 2) describes many recent important applications of rubber in industry and technology in general. The principal articles include 'Rubber Latex-Cement Compositions', 'The Progress of Rubber in Roads', 'Rubber Formers in the Manufacture of Wall Units' and 'Insulation of Refrigerating Plant with Rubberised Bitumen'. In this last article the development is traced of rubber-modified bitumen (RMB). As a result of a series of investigations RMBs are now available in stable easily trowellable form. RMBs have been in use at I.C.I. Billingham for two years and are standing up to atmospheric conditions satisfactorily. Breakdown has only occurred where there has been continued immersion in water.

* * *

A HANDY little leaflet which has recently been produced lists the range of thermoplastic raw materials made by BX Plastics Ltd., Higham Station Avenue, Chingford, London E.4. These include BX polythene,

Bextrene polystyrene injection moulding powder, Xylonite, and Isoflex. This consists of multi-layer pads of corrugated cellulose acetate film and is claimed to be the lightest thermal insulating material, weighing only 1 lb. per cubic foot. It lasts indefinitely and is easy to fit and to shape.

* * *

MONSANTO Chemicals Ltd., Victoria Station House, London S.W.1, believe that they are now able to offer an important development in rubber chemicals. This is 'pelleted accelerators' which facilitate the rubber compounding process, particularly where the incorporation of powdered materials is concerned. Pelleted rubber chemicals have many important advantages and characteristics, simpler transportation, ease of handling, and the absence of dust during mixing.

* * *

STURDY construction, combined with economical performance and low maintenance costs are claimed as characteristics of Holmes-Connersville Positive Blowers. Publication No. 53 of W. C. Holmes & Co. Ltd., of Turnbridge, Huddersfield, gives details of the AFS and more recently designed AFS/A blowers. The principle in these blowers is that of two impellers, mounted on parallel shafts, rotating in opposite directions. These impellers are so constructed that during rotation a small, accurately gauged, clearance is maintained between them. One of the advantages of this system is that the volume of air displaced at each revolution is accurately known and the speed of revolution required for any particular purpose can be estimated simply. These blowers will provide both pressure or suction or a combination of the two.

* * *

THE Railway & Shipping Publishing Co. Ltd. have just published a revised edition of *Scale of Railway Standard Charges* which covers the 7½ per cent and the 15 per cent increases of rail charges which came into operation on 5 June. Covering charges from six to 730 miles, the publication will give the reader present cartage standard rates at a glance. The price is 20s., post free, from The Railway & Shipping Publishing Co. Ltd., 12 Cherry Street, Birmingham 2.



Headaches from Emulsion breaking?

Sequestrol (ethylene diamine tetra-acetic acid Geigy) completely inhibits the action of polyvalent metal ions such as those of calcium, aluminium, iron, etc., which so often cause instability in oil-in-water emulsions. Also, by its solubilising action on many inorganic substances in aqueous suspension, Sequestrol can reduce the tendency to emulsion breaking by large particles. Enquiries are welcomed.

*A pinch of
SEQUESTROL
may be the
answer.*

THE GEIGY COMPANY LTD., Rhodes, Middleton



MANCHESTER

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages & Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

GLAMORGAN ALKALI & ACID CO. LTD., London E.C.—10 June, £36,000 supplemental debenture, to Industrial & Commercial Finance Corp.; charged on property by a debenture dated 1 October, 1952, and a general charge. *£150,000. 22 March, 1955.

INTERNATIONAL LABORATORIES LTD., London S.W.—1 June, charge, to Barclays Bank Ltd. securing all moneys due or to become due to the bank; charged on 205 Hook Road, Surbiton. *£19,986. 14 October, 1954.

Satisfactions

BROWN & FORTH LTD., London N.W., chemical manufacturers, etc.—Satisfaction, 10 June, part of property comprised in mortgage and debenture registered 12 November, 1954 (Cornbrook Works, Chorlton Road, Brooks Bar, Manchester, ceased to form part of the company's property or undertaking).

HORDERN-RICHMOND LTD., Haddenham.—Satisfaction, 6 June, of mortgage and charge registered 5 April, 1950.

WESSEX PLASTICS LTD., Bath.—Satisfactions, 6 June, of debentures registered 29 April, 1947, 9 February, 1951 and 2 April, 1952.

UNIVERSAL PLASTICS LTD., London N.—Satisfaction 15 June, of mortgage registered 7 August, 1945.

Company News

Head, Wrightson & Co.

The board of Head, Wrightson & Co., engineers, now recommend a final dividend of 12½ per cent making, with the interim

dividend of five per cent already paid, a total of 17½ per cent for the year. In his statement, Mr. Richard Miles, the chairman and managing director, said: 'Our work in the chemical field, coupled with our appropriate manufacturing facilities, resulted last year in our being invited by the oldest and leading manufacturers of modern prime movers, C. A. Parson & Co. Ltd., to join a consortium for the production of complete nuclear power plants. Our oil and chemical section has in hand important work for chemical and heat exchange equipment for the oil industry in many parts of the world.'

British Industrial Plastics

The directors of British Industrial Plastics have declared an interim dividend on the ordinary of 7½ per cent on account of the year, to 30 September, 1955. For the previous year an interim of 7½ per cent was paid on the capital prior to the 50 per cent scrip issue followed by a final of 12½ per cent.

British Oxygen Co.

The price of the new shares to be issued by the British Oxygen Co. has been fixed at 50s. The company is issuing 3,247,079 £1 ordinary shares at 50s. each on the basis of two for every £5 of stock held on 27 June. The new shares will not be entitled to any interim dividend for the nine months' accounting period to 30 September, but will be entitled to the full amount of any final dividend for that period. Provisional allotment letters will be posted on or about next Monday, 25 July.

The Metal Box Co. Ltd.

Profits of the Metal Box Co. Ltd. last year, after depreciation, rose from £1,731,000 to £2,472,000. Home sales increased from £33,424,000 to £41,166,000; overseas sales from £10,165,000 to £11,437,000. This represented a total increase of £9,000,000 over the previous year. The ordinary dividend has been raised from 15 per cent to 20 per cent; and £1,200,000 put to reserve. The sales of the overseas subsidiaries reached a record of over £11,000,000, and the consolidated trading profit was a record at £1,306,653. The 34th AGM of the company, and the 7th AGM of the Metal Box Co. Overseas Ltd., were held in London on 15 July.

(continued on page 194)

Spectroscopic Solvents

2:2:4-Trimethyl-pentane has been added to the series of specially prepared spectroscopic solvents which the B.D.H. catalogue has included for many years. These are already being issued under the new B.D.H. "specification" labels, in which the transmission minima shown are as under :

SOLVENT	Minimum percentage transmission in a 1 cm. cell at	
	220 m μ	250 m μ
Cyclohexane	45	95
Ether	25	80
Ethyl alcohol 95%	50	95
Ethyl alcohol, absolute	50	95
Hexane, fraction from petroleum	70	95
iso-Propyl alcohol	60	95
2:2:4-Trimethyl-pentane ("iso-octane")	50	95

Prices for B.D.H. solvents for spectroscopy, in small or large quantities, will be quoted on request.

THE BRITISH DRUG HOUSES LTD.
B.D.H. LABORATORY CHEMICALS GROUP
POOLE DORSET

SS/LC/551b

BDH

Company News

continued from page 192

The Yorkshire Dyeware & Chemical Co. Ltd.

Profit for the year ended 31 March, 1955, of The Yorkshire Dyeware & Chemical Co. Ltd., was £326,633, compared with £305,558 for the previous year—an increase of £21,075. Taxation requires £132,977 against £134,842, and after deduction of this and other charges leaves a net profit of £128,026, which, however, includes the Leather Charges Stock Reserve amounting to £11,348, compared with £100,645 last year. With £26,102 brought forward there is £154,128 available for distribution, out of which has already been paid the preference dividend to 31 December, 1954, and an interim dividend of five per cent on the ordinary stock which together amount to £21,175. It is proposed to increase the general reserve by £45,000. The directors recommend a final dividend of 10 per cent together with a bonus of five per cent, which together with the interim dividend of five per cent makes a total of 20 per cent for the year.

Canadian Oil Co.

In order to become a fully integrated company, the Canadian Oil Company has made an offer to acquire the assets of Anglo-Canadian Oil Co., a Calgary, Alberta, oil production and development company. The offer of \$2.75 cash, plus one-seventh of a share of Canadian Oil for 3,779,376 Anglo-Canadian shares, works out at about \$6.25 per Anglo-Canadian share, or a total of \$23,621,000. The Anglo-Canadian directors have unanimously accepted the offer. Production of Anglo-Canadian last year was 956,697 barrels of oil from seven Western Canada fields.

Shell Company of Australia

At the end of 1954 the Shell Co. of Australia had a total capital investment in Australia of more than £A43,000,000, the directors state in their annual report. Capital expenditure was £A8,000,000; £A500,000 less than in the previous year. The marked increase in capital funds since 1950 resulted mainly from the refinery construction programme at Geelong, Victoria, and Clyde, NSW. It is stated that the Geelong refinery saved Australia £A1,000,000 in foreign exchange last year.

Kaiser Aluminium & Chemical Corp.

The Kaiser Aluminium & Chemical Corp. of America is considering raising

\$80,000,000 for capital improvements to expand production of aluminium. The board of directors have voted to redeem the company's outstanding five per cent cumulative preferred stocks. It is understood that the Corp. is contemplating the public sale this autumn of \$35,000,000 of sinking fund preferred stock accompanied by private debt financing of about \$40,000,000, plus rearrangement of the present bank debt.

Market Reports

LONDON.—The demand for industrial chemicals remains good although the proximity of the holiday period has made for less active conditions and reduced the movement against contracts. Export trade in chemicals continues to be affected by the recent delays at the docks and the smaller volume of inquiry is thought not to be entirely due to seasonal influences. The biggest factor in the market outlook is the higher costs of production and transport which are inevitable as a result of the rise in the price of coal. Most quotations are unchanged at recent levels but dry white lead has been advanced by £3 per ton, and red lead and litharge have advanced by £3 5s. per ton while cream of tartar is reported to be 20s. per cwt. dearer. The demand for the coal tar products persists with quotations firm.

MANCHESTER.—In spite of continued holiday stoppages at the consuming end, which are affecting to some extent pretty well all the industrial outlets of heavy chemicals in Lancashire, fair quantities are being taken up by the textile bleaching, dyeing and finishing trades, and traders on the Manchester market have little ground for complaint regarding the rate at which delivery specifications are circulating from other users. Fresh inquiry and replacement buying during the week have been on a fair scale. In the by-products section, there is a steady call for carboic acid, creosote oil, and most of the light distillates.

GLASGOW.—The Glasgow Fair holidays which commence this week-end have had their effect on the Scottish heavy chemical market. Business generally has had a tendency to fall off although a fair number of orders have been received for delivery before works close down. The export market still continues very satisfactorily.


JMS

BLEACHING AGENTS

Write Dept. B/16 for further details


J.M. STEEL & CO. LTD.

36/38, KINGSWAY LONDON WC2 Tel. HOLborn 2532/5

BRANCH OFFICES

51, SOUTH KING ST. MANCHESTER 2 Tel. Deansgate 6077/9

45, NEWHALL ST. BIRMINGHAM 3 Tel. Central 6342/3

CHEMICAL PLANT & PROCESSES

The Kestner organisation serves many industries. In fact, wherever chemicals are manufactured or used it is more than likely that you will find some Kestner plant—it may be a stirrer or other small item—it may be a large spray drier or the entire process plant. Whatever it be, large or small, you will find it doing "a good job."

If you are needing new plant, Kestners can help you on any of the following subjects:—

**ACID HANDLING ACID
RECOVERY PLANT • DRYING**

**PLANT • EVAPORATION PLANT • FLUID HEAT TRANSMISSION SYSTEMS • GAS ABSORPTION
AND REACTION SYSTEMS • ISOLECTRIC SYSTEM FOR PROCESS HEATING • KEEBUSH
LABORATORY AND PILOT PLANTS • STIRRERS AND MIXING EQUIPMENT**



New Twin Shaft Portable Propeller Stirrer (Patent applied for)

Kestner's CHEMICAL ENGINEERS

KESTNER EVAPORATOR & ENGINEERING CO., LTD. 5 GROSVENOR GARDENS, LONDON, S.W.1

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

BRISTOL WATERWORKS COMPANY

APPPLICATIONS are invited from persons, about 30 years of age, with suitable professional qualifications and with some knowledge of water supply practice, for an appointment as

CHEMIST/BIOLOGIST or BIOLOGIST/CHEMIST,
on the staff of the Company's Chemist and Analyst.

The person appointed will be concerned principally with problems associated with large reservoir storage of water and its subsequent treatment, and a unique opportunity exists for special studies.

Salary according to experience and qualifications.

Applications to:

**GENERAL MANAGER,
BRISTOL WATERWORKS COMPANY,
Telephone, Avenue, Bristol, 1,**

from whom further particulars may be obtained.

BRITISH TITAN PRODUCTS COMPANY LIMITED invites applications for posts in both its Research and Technical Sales Service laboratories from **GRADUATE CHEMISTS** with qualifications or experience in physical or inorganic chemistry; post-graduate qualifications would be an advantage. Applicants must be British subjects.

Conditions of work and service are very attractive and there are Staff Bonus and Superannuation Schemes and non-contributory Life Insurance cover. Commencing salary dependent on age, qualifications and experience. Assistance in house purchase and removal expenses is available for the successful applicant.

Application Forms may be obtained from the **PERSONNEL MANAGER, BRITISH TITAN PRODUCTS COMPANY LIMITED, COPPERGATE, YORK**, quoting reference S.14.F. All applications will be treated in strictest confidence.

CHEMICAL ENGINEERS

CHEMICAL ENGINEERS required by progressive Rayon Yarn Producers for research and development work. Applicants should be A.M.I.Chem.E., or have University Degree in Chemical Engineering. Good salaries, prospects and pension scheme. Applications, which will be treated in confidence, should state age, qualifications, details of experience, and be addressed to Personnel Manager, British Enka, Ltd., Aintree, Liverpool, 9.

CHEMIST with experience of synthetic detergents wanted for formulating and testing of detergent blends for wide range of industrial uses. The post offers excellent prospects and, depending on experience, can immediately carry a four figure salary. The Company have a well equipped laboratory situated in South Midlands and operate a five day week, pension fund, social club and canteen. All applications treated in strict confidence. Write **BOX C.A. 711, c/o 191, GRESHAM HOUSE, E.C.2.**

CHEMISTS, capable of occupying responsible positions in Australia, required by **LEWIS BERGER & SONS (AUSTRALIA) PTY. LTD., SYDNEY.** Minimum qualifications B.Sc. Age 30-40. Senior posts require at least 8 years' experience in the Paint, Varnish and Lacquer Industry. Applicants must have had service in a position of responsibility calling for organising ability and initiative. Suitable applicants will be interviewed in London during July or August. Apply in strict confidence, giving full details, to **PERSONNEL OFFICER, BERGER HOUSE, BERKELEY SQUARE, W.1.** marking applications "Australia."

CHEMISTS

CHEMISTS required by progressive Rayon Yarn Producers for research and investigation of process problems. Minimum qualification, A.R.I.C. Applicants should have experience of chemical process work and preferably also of textile technology.

Good salaries, prospects and pension scheme. Applications, which will be treated in confidence, should state age, qualifications, details of experience, and present salary, and be addressed to Personnel Manager, British Enka, Ltd., Aintree, Liverpool, 9.

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, ALDERMASTON, BERKS, requires a CHEMIST

in the grade of EXPERIMENTAL OFFICER,

to work in the materials field, i.e., plastics, adhesives, etc. Duties include advisory service in the plastics and adhesives field, and development work with new materials is also involved. The minimum qualification is H.S.C. in Chemistry, or equivalent, but a Degree or A.R.I.C. would be an advantage. Applicants should not be less than 26 years of age. A good fundamental knowledge of the high polymer field is required, together with practical experience of resins generally, extended over a number of years.

SALARY.—£775 to £945 per annum (male). The successful applicant will be required to join the Authority's Contributory Superannuation Scheme.

HOUSING accommodation will be available on one of the Authority's estates within a reasonable period for married staff who now live outside the radius of the Establishment's transport facilities or alternatively the Authority may be able to assist the successful candidate in the purchase of a house. Until permanent accommodation is obtained a lodging allowance may be payable. Send postcard for application form, to:

SENIOR RECRUITMENT OFFICER,

**A.W.R.E.,
ALDERMASTON, BERKS.
Quote Ref. A597/WGE./38.**

ENGINEER, CHEMICAL ENGINEER OR CHEMIST with Engineering, Chemical & Technical Sales experience for developing and marketing Petroleum Chemical Plant, required by **THE POWER-GAS CORPORATION LTD., STOCKTON-ON-TEES**. Age about 30 years. The appointment will be confirmed on a permanent basis if satisfactory after a trial period of twelve months. It is anticipated that the post will involve periodic journeys abroad and in making the appointment emphasis will be placed on ability to grasp new ideas and techniques, together with initiative and commonsense.

INDUSTRIAL CHEMIST required by leading container closure manufacturers in Midlands. Progressive position requiring knowledge metal printing, varnishing, stoving, and metallurgy, associated with food packaging industry. Maximum age 35 years.—Written applications, with details of experience previous appointments, etc., to **P. A. METAL CLOSURES LTD., BROMFORD LANE, WEST BROMWICH, STAFFS.**

FOR SALE

ECONOMIC BOILERS. Two 8 ft. diam., 220 lb. w.p., 5,000 lb. evaporation; three 7 ft. 6 in. diam., 160 lb. w.p., 4,500 lb. evaporation; 400 other boilers in stock.

TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**

TWO Broadbent **WATER-DRIVEN CENTRIFUGES**, 30 in. diam., 12 in. deep, 1,150 r.p.m.

SIX Aluminium **CONDENSERS**, 14 ft. long by 2 ft. 3 in. diam. 386 Tubes, $\frac{1}{2}$ in. o.d.

FORTY Riveted **RECEIVERS**, 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lb. w.p. Numerous other sizes.

Solid Drawn **STEEL PIPES**, 6 in., 8 in., 10 in., 12 in., 14 in., thousands of feet in stock, plain and flanged.

CAST-IRON PIPES, 1,200 yds. 10 in. and 400 yds. 8 in., **NEW.** Also most other sizes, up to 24 in. bore.

VALVES in Stainless, Gunmetal, Enamel Lined.

CAST-IRON TANK PLATES, 2 ft. square. 500 in stock.

FRED WATKINS (BOILERS), LTD.
COLEFORD, GLOS.

MONEL METAL RIVETS, $\frac{1}{2}$ in. by 5/16 in., $\frac{1}{2}$ in. by $\frac{1}{2}$ in., $\frac{3}{4}$ in. by $\frac{1}{2}$ in. Round head, 7s. 6d. per lb. and mixture $\frac{3}{4}$ in. diam. to $\frac{1}{2}$ in. diam. 7s. 6d. per lb. 2 lb. post free. Also send for my list of 1,000 interesting items. Nuts, bolts, screws, etc., etc. **K. R. WHISTON (DEPT. CA), NEW MILLS, STOCKPORT.**

MORTON, SON AND WARD LIMITED offer **TWO** 50g **STAINLESS STEEL AUTOCLAVES**, 50 lb. p.s.i. internal pressure 20g stainless steel **JACKETED PAN**, bottom outlet, 40 lb. p.s.i., w.p. **NEW** stainless steel **CONTAINERS**, outlets optional, closed or open. **MIXERS** "MORWARD" "U" shaped **TROUGH MIXERS** in s.s. or m.s. made in all sizes, jacketed or otherwise. Scroll or paddle type agitators. 3 cwt. **TROUGH MIXER** by **CHALMERS**, s.s. lined tilting trough. 3 cwt. **TROUGH MIXERS** by **GARDNER**, s.s. lined troughs. **STRUCTURAL** and general **FABRICATION** requirements catered for **PUMPS**. A selection of new **MONO** and other second hand **PUMPS** in stock. 2" to 5". **ENQUIRIES** INVITED. **MORTON, SON AND WARD LIMITED, WALK MILL, DOBCROSS, NR. OLDHAM, Lancs.** Telephone: Saddleworth 437.

SELWOOD FOR PLANT. STORAGE TANKS FOR SALE. **SECTIONAL TYPE** 1,200 gallon to 24,000 gallon. **HORIZONTAL CYLINDRICAL** 500 gallon to 12,000 gallon, new and secondhand.

VERTICAL CYLINDRICAL 250 gallon **TVO** to 9,000 gallon.

RECTANGULAR ENCLOSED 190 gallon to 1,200 gallon, new and secondhand.

OVAL LORRY MOUNTING 200 gallon to 4,000 gallon, all types.

FULL LIST ON REQUEST. WILLIAM R. SELWOOD LTD. CHANDLER'S FORD, Hants. Phone 2275.

600

ROTARY DRIER by Vernon, Paris. 30 ft. by 4 ft. diam. of $\frac{1}{2}$ in. riveted mild steel plate, running on 2 roller paths. Motorized through girth gear and pinion. Fan, Cyclone and Furnace parts available.

Porcelain lined **BALL MILL** by Boulton, 16 in. long by 21 in. diam. Motorized 400/3/50.

Automatic **BOTTLE LABELLING M/C** by Peters, Slough. Capacity bottles up to 10 in. high, singly 4 in. wide, in pairs 2 in. 60 per min. singly, 120 per min. pairs. Motorized 400/3/50.

Automatic **CAPPING M/C** by Peters, Slough. Suitable for prescrewed caps and bottles or jars. Capacity 200/300 per min. Sizes $2\frac{1}{2}$ in. to 10 in. high by 4 in. diam. Motorized 400/3/50.

MELANGEUR by Lehmann. 6 ft. diam. cast steel construction with 10 in. by 6 in. side outlet. Twin granite rolls 27 in. diam. by 13 in. face underdriven through crown wheel and pinion with bare shaft extension. Ploughs and scrapers mounted on crosshead.

2 FONDANT MELANGEURS. 5 ft. diam. Pan 9 in. deep with copper bottom. Pulley drive.

NEW PORCELAIN AND SILEX LINED BALL MILLS, capacities ranging from 9 gallons to 260 gallons.

NEW STAINLESS STEEL STORAGE VESSELS AND TANKS, capacities ranging from 8 gallons to 1,000 gallons.

GEORGE COHEN SONS & CO., LTD.
WOOD LANE, LONDON, W.12.
Tel: Shepherds Bush 2070 and
STANNINGLEY, NR. LEEDS.
Tel: Pudsey 2241

POWDER MIXER BY BARRON—trough 30 in. by 18 in. by 18 in., driven through Vee-belts to 2 h.p. motor.

STEEL TROUGH MIXER—48 in. by 24 in. by 30 in. deep. Fast and loose pulley drive.

Good condition.

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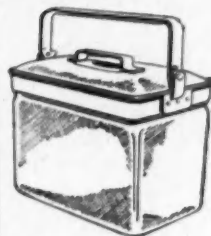
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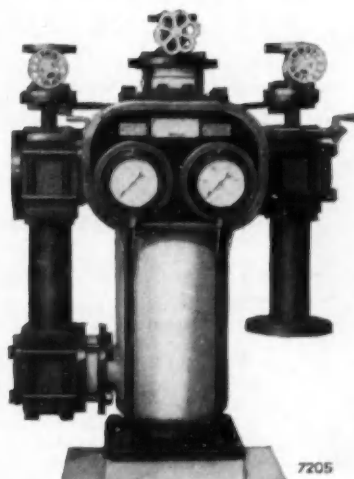
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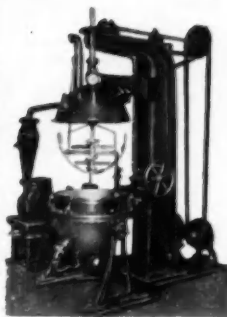
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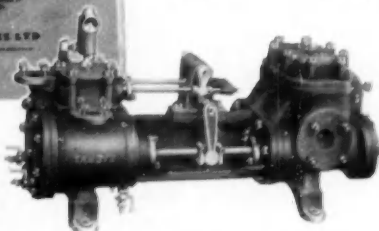
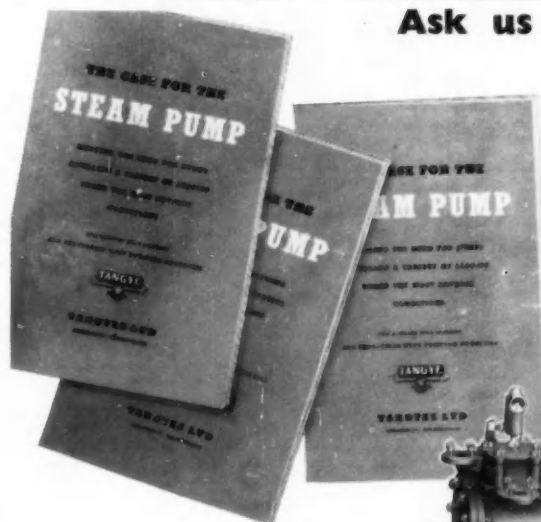
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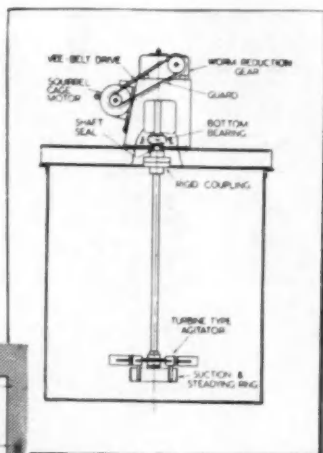
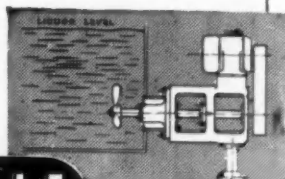
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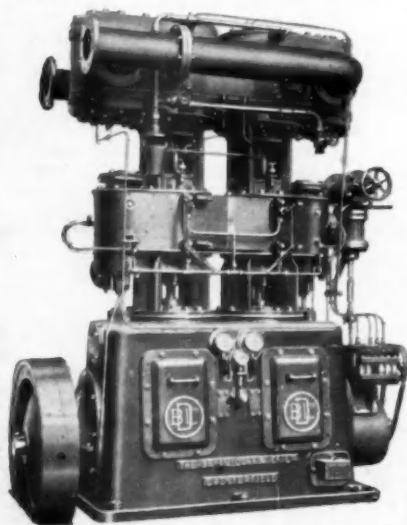
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